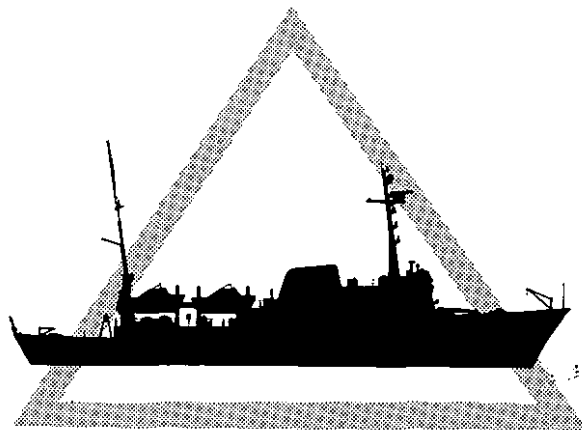


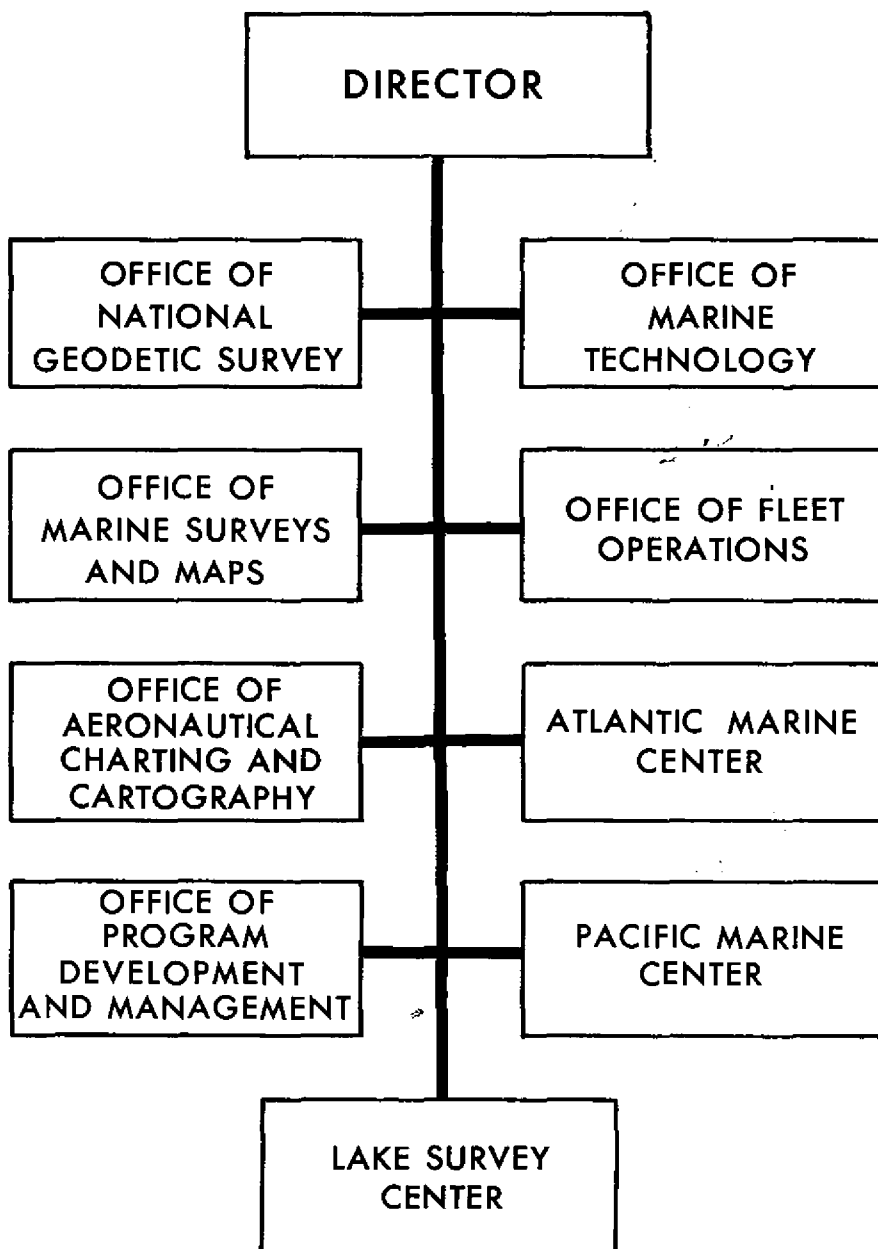
ANNUAL REPORT  
of the  
**NATIONAL OCEAN SURVEY**



FISCAL YEAR 1976



# NATIONAL OCEAN SURVEY



## NATIONAL OCEAN SURVEY

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NATIONAL OCEAN SURVEY  
ANNUAL REPORT FY 1976

Preface	
Message from the Director . . . . .	vii
Office of the Director . . . . . 1	
Board of Directors . . . . .	1
Research and Development . . . . .	1
Scientific Publications . . . . .	1
Marine Data Systems Project . . . . .	1
Office of the National Geodetic Survey . . . . . 5	
New Horizontal Adjustment . . . . .	5
Geodetic Research and Development . . . . .	6
Horizontal Network . . . . .	8
Vertical Network . . . . .	9
Gravity and Astronomy . . . . .	10
Satellite and Marine Applications . . . . .	11
Systems Development . . . . .	12
Field Operations . . . . .	13
Geodetic Information . . . . .	15
Office of Marine Surveys and Maps . . . . . 17	
Marine Charting . . . . .	17
Oceanography . . . . .	21
Oceanographic Statistics . . . . .	24
Coastal Mapping . . . . .	25
Marine Surveys . . . . .	28
Office of Aeronautical Charting and Cartography . . . . . 30	
Training . . . . .	30
Management . . . . .	30
Reproduction . . . . .	32
Aeronautical Products . . . . .	32
Public Sales . . . . .	36
Public Sales Data . . . . .	37
Office of Program Development and Management . . . . . 38	
Scientific Services . . . . .	40
Program Development . . . . .	45
Program Management . . . . .	48
Office of Marine Technology . . . . . 51	
Engineering Development Laboratory . . . . .	51
Oceanographic Instrumentation . . . . .	53
Data Buoy Program . . . . .	54

NATIONAL OCEAN SURVEY  
ANNUAL REPORT FY 1976

Office of Fleet Operations . . . . .	59
Operations . . . . .	59
Marine Engineering . . . . .	59
NOAA Fleet . . . . .	61
Atlantic Marine Center . . . . .	63
Marine Engineering . . . . .	64
Electronic Engineering . . . . .	65
Operations . . . . .	65
Vessel Operations . . . . .	65
Coastal Mapping . . . . .	66
Processing . . . . .	67
Pacific Marine Center . . . . .	68
Marine Engineering . . . . .	68
Electronic Engineering . . . . .	69
Operations . . . . .	69
Processing . . . . .	70
Vessel Operations . . . . .	71
Lake Survey Center . . . . .	74
Engineering . . . . .	74
Charts and Publications . . . . .	74
Hydrography . . . . .	74
Photogrammetry . . . . .	75
Transfer of LSC Functions . . . . .	75
Appendix . . . . .	76A
Publications Issued . . . . .	77A
Papers Presented . . . . .	79A
Papers Published . . . . .	84A
In Recognition...	
Awards and Citations . . . . .	85A
International Cooperation...	
Foreign Visitors . . . . .	87A

## ILLUSTRATIONS

1. Rear Admiral Allen L. Powell . . . . .	vi
2. New Datum Section Monthly Progress . . . . .	5
3. NGS Doppler Geceiver Program Status . . . . .	11
4. Field Terminal Operations Methods . . . . .	13
5. Geodetic Survey Markers . . . . .	14
6. NOS Information Trailer (Exterior) . . . . .	16
7. NOS Information Trailer (Interior) . . . . .	16
8. The One-Billionth Nautical Chart . . . . .	18
9. Offshore Telemetering Tide System (OTTS) Buoy . . . . .	23
10. Aerial Photograph of Annapolis Harbor . . . . .	26
11. Computationally Oriented National Data Optimum Retrieval System (CONDOR) . . . . .	31
12. Dulles International Airport Search and Rescue Chart . . . . .	33
13. Duo-Stat Self-Contained Camera . . . . .	34
14. OMRON CRT Terminal . . . . .	40
15. ADP Training Room . . . . .	42
16. Bicentennial Program: NOS Display Center . . . . .	44
17. Bicentennial Program: Bicentennial Serenade . . . . .	44
18. Civil Service Full-Time Permanent Positions and Employment . . . . .	50
19. Commissioned Officers Full-Time Permanent Positions and Employment . . . . .	50
20. Heave Error Corrector Subsystem . . . . .	52
21. Underway Water Sampling System . . . . .	53
22. Deep Ocean Buoy . . . . .	55
23. NOAA Ship DISCOVERER . . . . .	62
24. Dedication, Chesapeake Bay Bridge Tunnel Tide Gage . . . . .	63
25. PMC, Aerial View . . . . .	73
26. LSC, Waterfront View (Detroit River) . . . . .	75



Rear Admiral Allen L. Powell

## MESSAGE FROM THE DIRECTOR

Fiscal Year 1976 offered many opportunities for my review of National Ocean Survey activities, within the United States and abroad. In preparation for Bicentennial-year commemorations particularly, the vast scope and significance of our diversified programs was revealed.

This Report conveys a capsule-view of the National Ocean Survey's progress in carrying out its mission on all designated fronts--above, below and on the surfaces of the earth and the sea.

Ours is a heritage of exploration, innovation, high-accuracy performance and enduring contribution. We have met, and continue to meet, the challenge bequeathed to us by the Survey's "founding fathers"--those early 19th century visionaries whose perseverance gained congressional authorization for the Nation's crucial coast and geodetic survey work.

In the present era of computerization and space awareness, the National Ocean Survey utilizes automation, satellites, laser beams, radio waves, and a myriad of advanced techniques not imagined even 20 years ago. With steady progress, the Survey incorporates the latest innovations while continually refining and improving its established methodology. Our forward thrust is clear. Beyond keeping pace, we anticipate our national needs. The concentration of expertise in the NOS' unique fields of endeavor is unparalleled, and we enjoy the emphatic respect of related scientific and technical communities throughout the world.

As new horizons are reached, new programs will be implemented and new challenges met. I commend you, the men and women of the National Ocean Survey, for your motivation and foresight. Through your inspiration and diligence, the Survey continues to provide the foundation for far-reaching policies, on national and international levels.

Our work is of increasing significance to this Nation and the world.



Allen L. Powell  
Rear Admiral, NOAA  
Director  
National Ocean Survey

## OFFICE OF THE DIRECTOR

### Board of Directors

A Board of Directors was established and met for the first time in September 1975; there were subsequent meetings in January and June 1976. In addition to the Director and Deputy Director, members of the Board include the Associate Directors and Marine Center Directors. The Board was formed to serve a dual purpose--to improve communications between program managers and to recommend action on matters that effect several or all of the program areas.

### Research and Development

The Research and Development Council was formed in July 1975 to serve as a focal point for NOS research and development. It reviews on-going and proposed R&D, develops long-range R&D goals, promotes coordination between the R&D of different program areas, and makes recommendations to the Director and Board of Directors of NOS. The Council reviewed and commented on the R&D aspects of the FY 1978 budget submissions, and a preliminary report was prepared on proposed goals for the next decade of NOS research and development.

### Scientific Publications

Work continued toward the completion of a NOAA professional paper, The Strategic Role of Perigeon Spring Tides in Nautical History and North American Coastal Flooding 1635-1975. Eight of its 12 chapters are in galley proof stage at the Government Printing Office. Abstract material has received advanced reviews in the U.S. Navy's Sealift magazine, the East Bay Window (Phoenix-Times newspapers, Bristol, Rhode Island), and NEMRIP Newsletter #75, a Sea Grant project of the University of Rhode Island.

An article titled "J. G. Kohl and the Lost Maps of America" was prepared as an NOS contribution to a special Bicentennial edition of The American Cartographer. Two additional articles, one on "Tides" and the other on "Proxigeon Spring Tides," were written for the new Encyclopedia of Beaches and Coastal Environments.

### Marine Data Systems Project

The Marine Data Systems Project (MDSP), established in 1970 and scheduled for completion in 1980, was directed to design and develop a balanced automated nautical charting system and manage the resulting change-over throughout NOS.

### Data Acquisition Subsystem

To optimize use of the hydrographic survey data acquisition systems (HYDROPLOT) installed aboard twenty-two NOAA ships and launches, the MDSP initiated a contract in 1975 for two prototype electronic digital sextants that interfaced directly into the HYDROPLOT System. During 1976, the MDSP completed tests and accepted delivery of two prototype units and tested six additional production model sextants. All eight digital sextants were transferred to the Office of Fleet Operations for deployment to the NOAA Fleet. A manufacturers training course, now video taped by the MDSP for shipboard use, was sponsored by the MDSP for the benefit of operational personnel.

Marine Data Systems Project assisted the Engineering Development Laboratory with the development of a test plan for a prototype heave-error corrector, intended to provide a real-time correction factor to the HYDROPLOT System to account for wave action. Financial assistance was continued for the Engineering Development Laboratory's development and testing of the Offshore Telemetering Tide gage System (OTTS) to provide real-time tide data for offshore areas. MDSP will continue to monitor these efforts and provide assistance in the interest of improving the efficiency and effectiveness of hydrographic survey data acquisition and further optimizing the use of the HYDROPLOT Systems.

### Data Processing Subsystem

There existed at the Atlantic Marine Center (AMC) in 1970 a partially complete computer-assisted hydrographic survey data processing system which MDSP used as a developmental tool. Enough peripherals were added to it for the data to be processed directly as received from the HYDROPLOT units. This developmental work at AMC, enabled MDSP to purchase, in 1974, an up-to-date automated hydrographic survey data processing system for installation at the Pacific Marine Center (PMC). In 1976, assistance to AMC and PMC personnel was given in preparing a system feasibility study and procurement specifications to upgrade and make the AMC system compatible with the PMC system. A central processing unit and a high-speed vector-motion plotter were included in major hardware items purchased during FY 77, together with recommendations and specifications for adding two graphic digitizing tables at each Marine Center.

The MDSP entered into an agreement in 1972 with the National Climatic Center (NCC) (a component of the Environmental Data Service in Asheville, North Carolina) to digitally key to magnetic tape the data from 120 old hydrographic surveys that had never been processed but were considered worthwhile for inclusion in the hydrographic survey data bank. After they were revalued in 1975, the number of these old surveys to be processed was reduced to 75, and processing was completed by the end of June 1976. These surveys are now ready to be turned over to the Marine Centers for automated processing in a manner similar to a modern survey. MDSP worked with personnel from the Office of Marine Surveys and Maps to refine the new hydrographic survey processing procedures and to revalue the processing requirements for the existing unprocessed survey backlog.

### Chart Production Subsystem

In January 1972, in addition to the agreement made with NCC to log unprocessed hydrographic surveys, arrangements were made for NCC personnel to digitize 2,655 selected surveys--which constituted the active hydrographic survey data base used to construct nautical charts. During 1976, NCC personnel completed 728 surveys. The total completed to date is 2,541 or 96 percent of the number originally agreed upon. The remaining 114 surveys will be completed by September 1976. A follow-on agreement was negotiated with NCC to digitize 202 additional small-scale surveys and 371 Great Lakes surveys by the end of CY 1977.

The requirements for a computer-assisted data storage system to support the automated nautical chart compilation concept has been worked on since 1970. A system feasibility study and contract specifications were completed in January 1975; the request for proposals (RFP) was issued by the Department of Commerce on September 6, 1975; the RFP was closed on December 6, 1975; and a contract was awarded to Planning Research Corporation Information Sciences Company (PRC) on March 17, 1976. The contract specified September 17, 1976, as the delivery date for a central processing system, two work stations, and associated peripherals. The contract designates March 1978 for completion of the specified system software.

A Calcomp 748 high-speed vector-motion plotter was accepted in July 1975 for operational use. It, together with an older, slower Calcomp 718 vector-motion plotter, supports the development of the data base and the automated compilation techniques. These two plotters--in conjunction with a five table computer-controlled graphic digitizing system (located at NOS), and the NCC-produced contract work--were used to successfully produce six nautical charts. These include special overlays for oil pipelines and Gulf of Mexico mineral lease blocks, LORAN A-C navigation lattices to keep pace with the U.S. Coast Guard Modernization Program, and the facilities-listing for all small-craft charts published since 1973. To optimize the future use of automated graphics in the nautical charting production system, a contract for a state-of-the-art raster-motion laser plotter was contracted for in 1974. This "production capacity" plotter, delivered in 1975, was extensively tested before acceptance in May 1976. Since then, it has successfully produced the printing overlays for several charts. Although technically ready for operational use, full implementation of this plotter will not occur until the data storage and update system is operational.

As effort changed from developmental to operational, an extensive computer-software system was implemented. During 1976, to keep this system responsive to the needs of the various cartographers and engineers involved with the automated nautical charting program, numerous new programs were completed, old programs were revised to meet new requirements, and software system documentation was prepared to assist operational personnel in assuming more of the daily tasks required to implement the overall system.

In connection with the overall implementation effort, it became necessary for the personnel operating the graphic digitizing system to formally begin a two-shift work schedule in December 1975. Since then, several of the

compilation geographical area teams have made significant progress in the construction of base overlays and in continual chart maintenance with respect to incoming data. These steps are prerequisite to effective computer-assisted chart production. The personnel operating the vector-motion plotters continued to work a two-shift schedule to keep up with the production requirements.

#### Management Subsystem

A concerted effort has been made since 1970 to ensure that adequate training would be provided to accompany the introduction of every new technique or hardware system. In support of this training responsibility, an extensive video tape capability was developed to allow small investments in training courses to be extended to benefit many employees over the course of several years. During 1976, in addition to the manufacturer's training course on the digital sextant, personnel prepared and presented several training programs to introduce nautical chart cartographers to the general ADP procedures, and to the specific equipment to be implemented in the NOS Automated Nautical Charting System.

MDSP sponsored the Third Annual Hydrographic Survey Processing Conference in Rockville, on November 18-21, 1975. Thirty employees from AMC, PMC, the Lake Survey Center, and the Office of Marine Surveys and Maps, attended these sessions. The responsibility for coordinating this conference, initiated by the MDSP in 1973, was turned over to the Office of Marine Surveys and Maps as part of the phased transition plan.

MDSP continued to sponsor monthly liaison meetings with other NOS line elements. These meetings provided a major opportunity for interdisciplinary communication within NOS, and kept other NOS elements informed of the MDSP progress.

As part of our continuing liaison with chart automation efforts in foreign countries, the Chief, Marine Data Systems Project, attended the Fifteenth Annual Canadian Hydrographic Conference in Ottawa, Ontario in April 1976.

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## OFFICE OF THE NATIONAL GEODETIC SURVEY

The Office of the National Geodetic Survey (NGS) is responsible for the mathematical study of the size and figure of the earth, and for the development of geodetic control surveys. Its activities include the determination of extremely precise geographic positions, known as longitude and latitude; the establishment of accurate elevations of marked points; gravity and geodetic astronomic determinations; crustal movement studies; and geodetic mark maintenance.

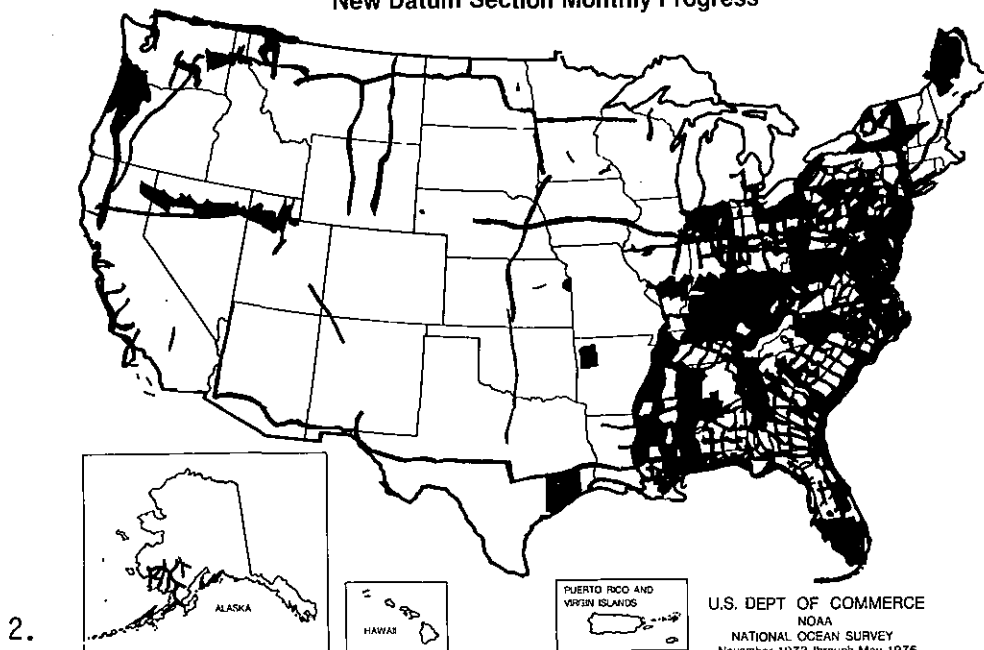
The average number of NGS personnel was 374, including 9 commissioned officers; an average of 173 office personnel and 192 field personnel including the Instrument and Equipment Branch and the Observatories.

### New Horizontal Adjustment

#### North American Datum

Significant steps were taken toward the accomplishment of the new adjustment of the continental networks of geodetic horizontal control known as the North American Datum (NAD), scheduled for completion in 1983. The main thrust of the NAD effort is the exhaustive project-by-project conversion of horizontal control data to computer-readable form. The New Datum Section of the Horizontal Network Branch processed data from 36,000 stations. The total number of stations from which data has been processed to date is 80,000, or about 40 percent of all horizontal control data accumulated in the archives of the NOS in more than 150 years (see illustration 2).

New Datum Section Monthly Progress



Complementing this massive data-conversion effort, significant advancement was made in the design and development of three major software packages required in support of the new adjustment of the NAD. The TRAVIO (traverse to the 10th degree) network adjustment package, the primary tool used in the processing of horizontal control data, was significantly improved. This adjustment package has been adopted for use by the U.S. Geological Survey, the Defense Mapping Agency Topographic Center, the Geodetic Survey of Canada, and others.

Two other major software systems being developed in support of the new adjustment of the NAD are the Helmert Block Adjustment Package and the Data Base Management System. The new adjustment of the NAD will be accomplished by the Helmert Block Adjustment Package. This software system will be required to perform a simultaneous least-squares solution of some 2.5 million linear equations in perhaps as many as 500,000 unknowns--a computational task of tremendous magnitude, perhaps without parallel. A prototype version of this software system was successfully tested. The development of the Geodetic Data Base Management System, and of the associated application of the software system, has suffered from the continuing uncertainty concerning the computer facility on which this storage-intensive software system is to be installed; nevertheless, significant progress has been made. The Data Base, which is ready for the entry of positional data to create station records, will accept descriptive data shortly. Automatic publication of horizontal control data sheets, in a new machine-generated format, is expected within the next six months.

The NAD staff has expended a great deal of effort in two other activities. One is the design and development of a software system for the daily processing of data acquired by NGS field parties. This system uses remote computer terminals connected by telephone circuit to a large host computer in the Washington, D. C. area. The implementation of this system marks the dawn of a new era in the acquisition and processing of geodetic data.

#### User's Guide

The other significant activity underway is the preparation of the user's guide entitled, Input Formats and Specifications of the NGS Data Base. This publication, which is about 50 percent complete, will be the authoritative guide for the submittal of geodetic control data to the NGS in computer-readable form. It is expected to stimulate the transfer of geodetic data to the NGS from other agencies concerned with mapping, charting, and geodetic activities.

#### Geodetic Research & Development

Altimeter data from GEOS-3 is now being supplied by NASA. To handle this, a data base utilizing a IBM disk pack was implemented on the IBM 360/195 computer. This enables any user of the data base to access the altimeter measurements both randomly (direct access) and sequentially. Computer programs were completed which improve the worldwide gravitational field by adding the altimeter data to existing solutions employing the density layer method of representation.

The SEASAT-A satellite, scheduled for launch in 1978, will carry an altimeter of much higher precision than GEOS-3, and will have the capability of measuring departures of the sea surface from the geoid. Plans for determining the geoid to the requisite accuracy, and for computing an equally precise satellite ephemeris, were drawn up and submitted as part of an overall NOAA Program Development Plan.

Using a new technique, the mean semi-major axis of a geodetic satellite was determined to a precision of two centimeters from real tracking data. This achievement has an important implication for SEASAT operations for evaluation of difficult-to-model effects such as atmospheric drag, direct and Earth-reflected radiation pressure, and geo-potential resonances.

Analysis of observations on a Navy navigational satellite yielded  $M_2$  ocean tide parameters which confirm the broad features of several recent terrestrial-based numerical models.

Orbit analysis and prediction programs on the IBM 360/195 developed by the Geodetic Research and Development Laboratory (GRDL) are being used by NOAA/NESS, the Jet Propulsion Laboratory (JPL), and by the Defense Mapping Agency Topographic Center (DMATC).

A Sea Level Observation and Prediction Experiment (SLOPE) was initiated to check the discrepancy between geodetic and oceanographic leveling results along the U.S. Pacific Coast by obtaining independent measurements using the JPL portable radio interferometer.

An investigation of the effect of data from Geoceivers to a horizontal network showed that the influence is inversely proportional to the number of measured distances already contained in the network.

Tests of deflection prediction from sample data disclosed that the choice of covariance function does not strongly influence the predictions, but it does influence the standard deviations of the results. Furthermore, an azimuth-dependent model matched the data better than an isotropic model.

In connection with the new horizontal adjustment, a prototype computer system was developed and successfully tested to solve large triangulation networks using the Helmert-Blocking techniques. These programs include a new technique for reordering the normal equations within a block to optimize storage and a new procedure for computing the inverse within the profile.

In order to improve and economize existing leveling procedures, a critical analysis of present-day leveling instrumentation systems was conducted. This resulted in plans to acquire and test new instrumentation systems with special emphasis being placed on motorized leveling procedures.

## Horizontal Network

The high precision traverse will be completed by late fall 1976 when the remaining section of about 200 km in Michigan is observed. The last 175 km segment in southern California and about 500 km in northern Michigan were measured in FY 1976. In the section from Port Hueneme, California, to the Mexican border several lines were in excess of 60 kms.

The processing of data in support of the New Adjustment of the North American Datum continued on schedule. Several test adjustments were made in which 10 to 25 projects were consolidated in simultaneous computations. New computer software was developed to reorder the unknowns, determine the solvability of networks, and to adjust zenith distance observations.

A number of projects observed primarily to strengthen the network were undertaken. First-order surveys were completed in Maine, Pennsylvania, Maryland, West Virginia, Ohio, and North Carolina. A first-order arc in central Illinois was started and is expected to be completed in 1977. To provide additional scale for the New Adjustment, first-order base lines were measured using electro-optical equipment in North Carolina, Ohio, and West Virginia.

Adjustments were completed for 36 projects and the resulting data for 2,933 stations were placed in the published files. Major adjustments were completed for surveys in northwest Arkansas and Salt Lake County, Utah.

First-order cooperative surveys in Maine, Connecticut, and Georgia continued. A first-order cooperative project in Michigan is underway to satisfy some of the geodetic control needs of the state.

Two large projects in Alaska were observed in cooperation with the Bureau of Land Management. One network was in the vicinity of Lake Iliamna and the other in the Yukon-Kuskokwim Delta area. Both were accomplished using trilateration methods, and a few direction observations were obtained. New type microwave equipment, which allows the antennae to be elevated while the rest of the equipment remains on the ground, was used.

The traverse along the United States-Mexico Boundary, often identified as the "California Azimuth" was completed. Connections were made to all boundary monuments. This high accuracy survey, when reobserved in the future, will provide a better evaluation of tectonic activities in this highly seismic area. Resurveys to study crustal movement along the San Andreas fault system were made at the VERAS and UNION sites. A study to examine the possibility that the San Andreas fault line returns to the California mainland near Shelter Cove was made.

The program to establish base lines for calibrating electronic distance measuring equipment and tapes continued. Base lines were established in Alabama, Kentucky, Louisiana, Maine, Mississippi, Oklahoma, Texas, and Wisconsin. About 50 calibration base lines have been measured to date.

Special projects were undertaken at the request of the Jet Propulsion Laboratory, California Institute of Technology, at several locations involved in the ARIES program and for the University of Hawaii at the Haleakala Observatory on Maui.

Reestablishment of lost or disturbed monuments along the north-south Mason-Dixon Boundary Line between Delaware and Maryland continues. Similar work along the east-west Transpeninsular Line, which forms the boundary for the same states, is also in progress.

As part of the continuing program to accept data surveyed to National Network standards by other agencies, projects were received from the Bureau of Land Management; U.S. Geological Survey; North Carolina Geodetic Survey; the Highway Departments for the States of Arizona, California, Florida, Georgia, Louisiana, Minnesota, and New Mexico; King County, Washington; Los Angeles County, California; City of Richmond, Virginia; and other local organizations.

#### Vertical Network

The NGS accomplished a total of 7,418 kms of leveling, on which 2,070 bench marks were set.

Leveling by other organizations (state highway departments, state geodetic surveys, local government units, etc.) processed by the NGS for inclusion in the National Geodetic Control Network included 2,840 kms of second-order and 510 kms of first-order.

Major conventional projects included first-order releveing as follows:

- o 360 kms on 3 level lines in the State of Georgia
- o 630 kms along the Mississippi River in Louisiana
- o 465 kms along the Mississippi River in the States of Missouri and Arkansas

Special survey projects include the following:

- o 114 kms releveled through the Geyser's geothermal area in northern California to detect elevation change
- o 311 kms releveled over the Adirondack Dome in New York State to detect elevation change
- o 98 kms leveled from Hilo to Mauna Loa, Hawaii, to serve as a basis for detection of elevation change
- o Leveling from Baltimore to Waldorf, Maryland, to test instrumentation and leveling procedures

- o 173 kms releveled from Whittier to Anchorage, Alaska, to detect crustal movement
- o 891 kms leveled along the Alaskan Pipeline to support engineering work and monitor crustal movement
- o 430 kms of releveled in southeastern California to define the eastern extent of the Palmdale Uplift feature

Project PVNA (Primary Vertical Network Analysis) is an effort to place, in machine-readable form, data elements essential for investigative readjustments, and analyses, of the first-order control network. Observational data obtained prior to 1962 has now been placed in the data file.

Cornell University continued a cooperative effort to produce crustal movement profiles for inclusion in the NGS Crustal Movement Profile Library. There are now 528 profiles of elevation change in the library; 209 were prepared by Cornell.

A new type of single-run leveling was developed and tested. Improved field procedures, involving different rod types and automated recording equipment, facilitate detection of reading errors. The new method is less costly than double-run leveling and consequently, area coverage can be increased without excessive loss of precision. This technique is particularly suitable for crustal movement surveys.

An automated recording system was developed. Data is entered on a battery-powered programmable calculator. Computations and checks are automatically performed, and data are stored on magnetic tape cassettes. Semi-intelligent terminals read the tape cassettes, reformat the data, and send it to a centrally located large computer for further checking and reduction.

## Gravity and Astronomy

### Geodetic Astronomy

A total of 91 astronomic positions were established by two field units. Astronomic positions for the Wisconsin-Michigan section of the high precision traverse were observed. Additional stations were established for Laplace control in Connecticut, Illinois, Kentucky, Montana, Nebraska, New Mexico, Texas, West Virginia, and Wyoming. Fifty astronomic azimuths were determined.

Two special projects involving the precise determination of the difference in latitude between the U.S. Naval Observatory PZT and the Gaithersburg VZT; and the precise difference in longitude between the USNO PZT and the Richmond, Florida PZT, were completed. These two programs involved the observation of 240 star pairs for latitude and 91 sets of eight stars each for longitude.

## Astronomic Computations

Astronomic data processing remained current with field work. A detailed analysis of the differential latitude and longitude data is underway for unifying all NGS longitudes and estimating astronomic position accuracies.

## Variation of Latitude

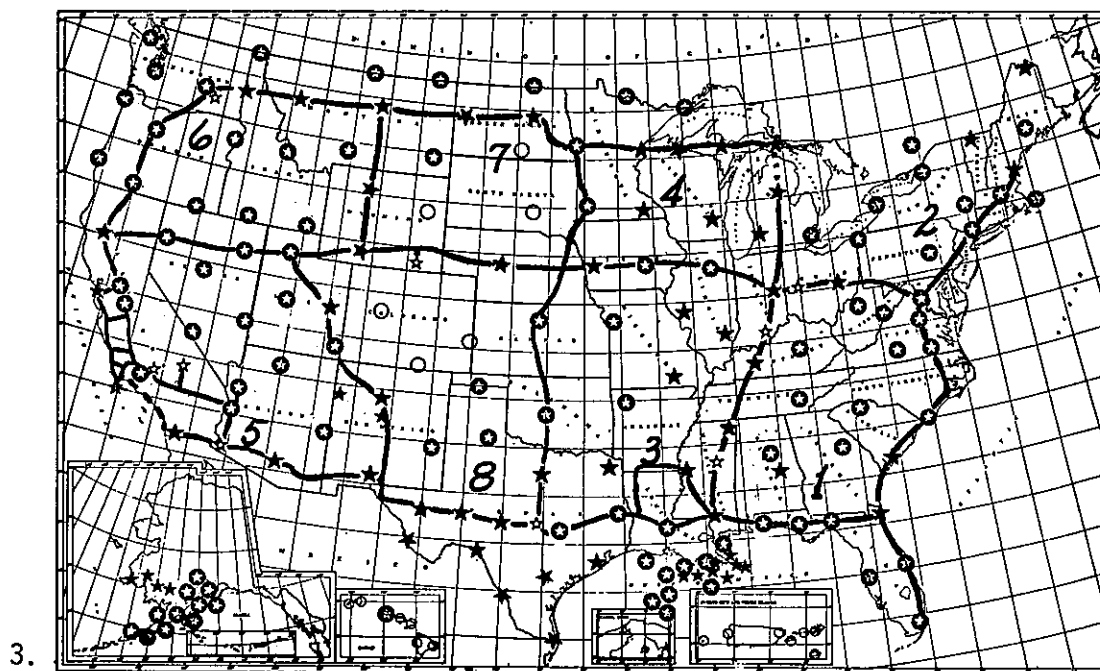
The variation-of-latitude observatories at Ukiah, California, and Gaithersburg, Maryland, continued operations. At Ukiah, 2,779 star pairs were observed on 192 nights; and at Gaithersburg, 2,029 star pairs were observed on 157 nights. Latitude observing records were transmitted weekly to the Central Bureau of International Polar Motion Service in Misuzawa, Japan.

## Satellite and Marine Applications

Doppler satellite observations were obtained at 80 stations throughout the United States including 26 stations along the high precision traverse. Thirteen stations were located in the south-central area of Alaska. Four stations were located on offshore oil platforms in support of final evaluations for Doppler satellite positioning on offshore structures. Seven stations were established jointly with Canada along the western part of the United States-Canadian border (see illustration 3).

### NATIONAL GEODETIC SURVEY DOPPLER GEOCEIVER PROGRAM - STATUS

- ⊙ Stations Completed - NGS
- ★ Stations Completed - DMATC
- ☆ Stations Completed - DMA Test Program (1971-72)
- Stations Proposed



Data reduction was performed for 11 Doppler stations in Alaska, established by the Bureau of Land Management.

Evaluations of results of observations during multiple periods were carried out to investigate the ability to use Doppler for decimeter accuracy positioning and to establish satisfactory accuracy estimates for Doppler results.

#### Gravity Reductions and Analysis

Reobservation of the U.S. National Gravity Base Network was 75 percent completed. Extensive analyses to relate elevation change and gravity change were carried out. Methods for computation of gravimetric deflections were developed and tested.

#### Gravity Observations

Gravity observations along level lines were carried out in southern California and Texas. Observations were completed over the central section of the U.S. National Gravity Base Network. Regional gravity coverage was established in Florida and Georgia to support gravity deflection computations.

### Systems Development

The Systems Development Division (SDD) continued to devote a major effort toward the development of the Geodetic Data Base Management System (GDBMS). The effort involved three major areas: The Master Control subsystem; application programs to input, update, and retrieve positional data; a series of programs to support the preparation of data for data base entry.

The Master Control subsystem is concerned with control of queues, scheduling of requests, analysis of query language statements, initiation of applications which require internal job processing, space management, and data migration.

The programs to input, update, and retrieve horizontal positions and related publication data were completed and demonstrated. These programs also maintain the horizontal index and directory.

Programs were designed and coded to support the preparation of horizontal and astronomic positional data for data base entry. These systems of routines address the central problem of matching together all machine-readable documents which refer to the same station. The system for matching astronomic positions and azimuths to their proper horizontal stations was completed and demonstrated.

New application programs written during the year were prepared for the NOAA IBM 360/195 computer. A program library was established on the 360/195. The library system includes a set of cataloged executable load modules, a set of cataloged procedures, a set of utility routines for general purpose use, a file of user instructions in machine-readable form, and a set of routines to access the user instructions. The capabilities of approximately 80 percent

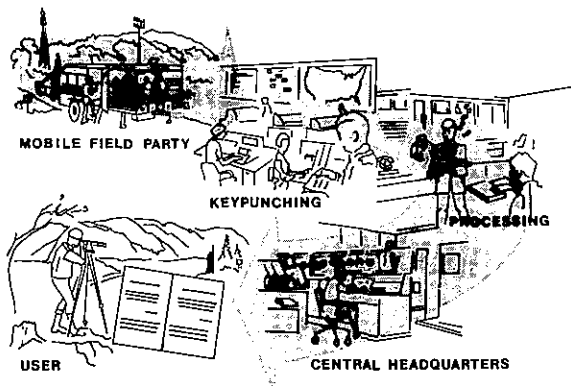
of the routines in the NGS 6600 production program library were achieved by routines in the 360/195 library. Plans were made to accomplish the other 20 percent so that a complete duplicate operational capability will be available.

The Division also operates a computer Remote Job Entry (RJE) terminal in the Rockwall Building for the use of NGS. The workload handled by this RJE site during the year averaged slightly over 200 jobs per day.

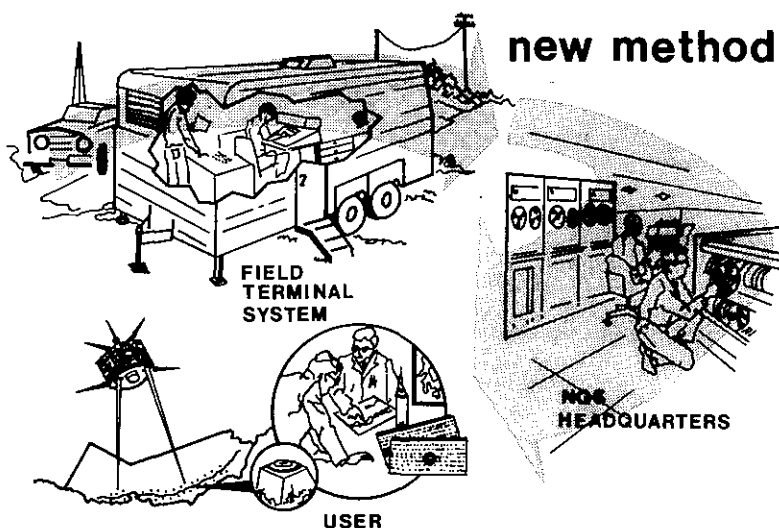
### Field Operations

The Field Operations Division directed the activities of 15 field parties, four geodetic advisors to states, 15 mark maintenance units, and the Instrument and Equipment facility at Corbin, Virginia. Training in geodetic surveying was accomplished through cooperative projects with state, Federal and local agencies and through special arrangements with other agencies.

#### old method



#### 4. Field Terminal Operations



There were 1,408 vertical control marks and 1,324 horizontal control stations visited and found in good condition by maintenance personnel. A total of 877 were preserved or relocated. This total includes 503 vertical control marks and 374 horizontal control stations. In addition, 197 vertical control marks were reset by private, state and county engineers.

The National Geodetic Survey received and processed 10,563 Report on Condition on Survey Mark cards, of which 373 marks required maintenance.

During the period, 4,981 witness signs and 3,951 posts were issued to private surveyors to be set near NOS horizontal and vertical control points (see illustration 5).



5. Geodetic Survey Markers

## Geodetic Information

The National Geodetic Survey Information Center (NGSIC) received, researched, and processed 6,200 requests for geodetic data, in addition to completing 8,900 mailings through the automatic mailing service. The demand for information was processed at an average rate of seven units per hour. These requests, which accounted for the dissemination of approximately 1.6 million sheets of geodetic control data, were received from the following sources:

	<u>Daily Requests</u>	<u>Automatic Mailing Requests</u>
Federal Agencies	35.0%	38.1%
State, Local Agencies	8.8%	33.3%
Universities, Professional Societies, General Public, etc.	9.0%	7.4%
Commercial/Private Industries	47.2%	21.2%

In response to 413 requests for special publications from NGS holdings, 1,578 complimentary copies were provided to various users. Seventeen requests for airline distances, arcs for radii determination of distances and other cartographic compilation/computational work were satisfied. Requests for this type of information came from attorneys, judges, transportation companies, as well as state and Federal agencies concerned with intra- and interstate commerce who require these special cartographic products for regulatory responsibilities. Twelve requests for geodetic data in other than paper form were received and processed, i.e., vertical control data on computer output microfilm, gravity data on magnetic tape, and geographic positions for horizontal and vertical control marks on magnetic tape.

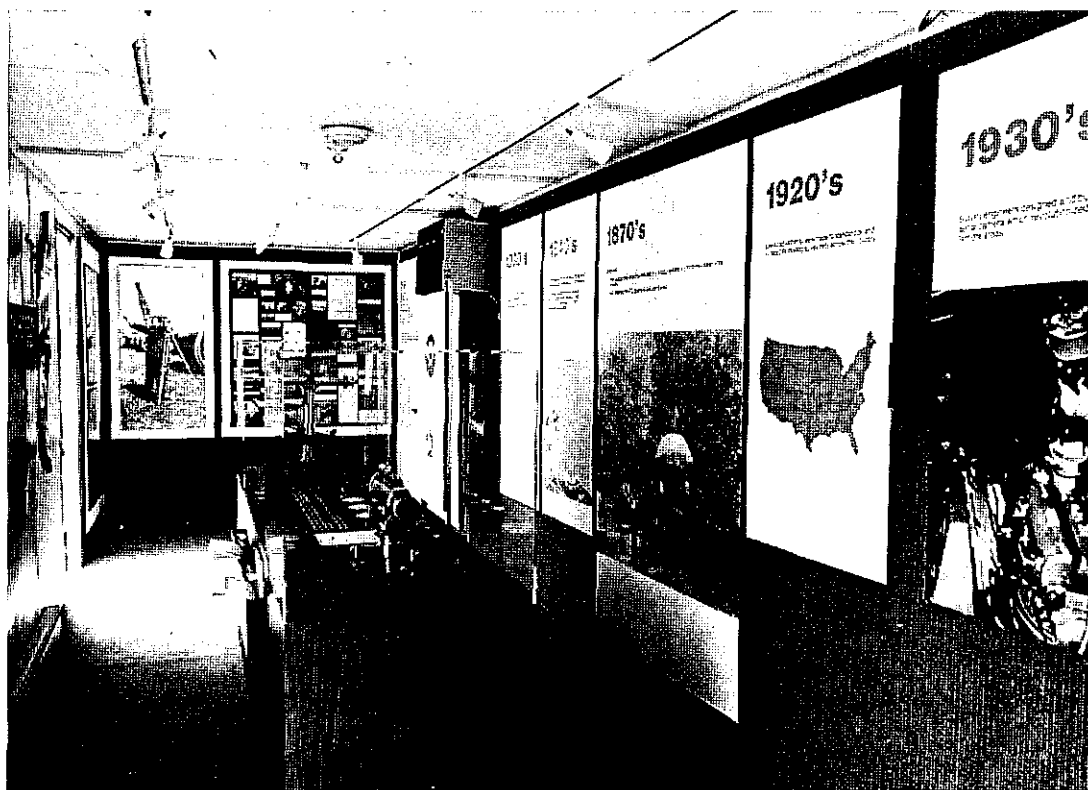
Considerable preparation for contract digitizing of station descriptions of geodetic control marks has been done. The NGS has contracts for digitization with Federal Prison Industries, Inc., Alderson, West Virginia, and Ft. Worth, Texas; and Steele Data Processing, Inc., Detroit, Michigan.

	<u>No. of Stations</u>	
	<u>Horizontal</u>	<u>Vertical</u>
Prepared for contractor	91,500	135,000
Sent to contractor	44,000	135,000
Received from contractor	27,500	53,600
Edit run	27,500	53,600

In support of the Palmdale, California crustal study, the Cartographic Branch and the contract plotters of Authorization Systems, Inc., plotted 6,400 stations; 1,000 stations were digitized, converted to geographic positions and provided on magnetic tape to Vertical Network Branch.



(6. and 7.) The NOS Information Trailer, designed as a public education exhibit, depicts graphically and through print, the history and services of the National Ocean Survey's geodetic work.



## OFFICE OF MARINE SURVEYS AND MAPS

The Office of Marine Surveys and Maps is responsible for all data acquisition for, and the publication of the Survey's most important marine product, the nautical chart. This Office serves as the focal point for planning and managing marine programs in addition to the analysis and dissemination of data collected within the more than two and one-half million square miles of ocean under NOS responsibility.

### Marine Charting

To assist in developing computer supported cartographic applications and automated nautical chart production, a Chart Planning and Technology Group and an Automated Cartography Group were established on February 15, 1976, as part of the staff of the Marine Chart Division Chief. The Chart Planning and Technology Group is charged with obtaining and analyzing survey and charting requirements, developing priorities, and making plans for chart production. In addition, the Group is assigned the task of developing new cartographic procedures, techniques, and ideas, to improve quality and usefulness of nautical charts and to meet new requirements for marine data description. The Automated Cartography Group coordinates the resources of the Marine Chart Division (MCD) to efficiently and effectively support the development of the NOS automated cartographic effort. The Group provides technical advice and recommendations, manages the overall automation effort in the MCD, and provides for implementation of specific procedures.

New concepts for implementing automated cartographic support in the Nautical Chart Branch (NCB) resulted in abolishment of the "Automated Team" (Team 8). Personnel from the "Automated Team" were integrated into the new Automated Cartography Group, and the geographic area teams of the NCB.

To effect an overall savings in the NOS, the Lake Survey Center (LSC) at Detroit, Michigan, was abolished on June 30, 1976. This resulted in the transfer of NOS nautical charting efforts for the Great Lakes to the MCD. To prepare for LSC closing and to assist management of the NCB, Team 7 was designated the Great Lakes Area Team and the former Special Project Team 7 was designated Team 8. As part of the closing of the LSC, responsibility for production of the Great Lakes Pilot was transferred to the Coast Pilot Branch.

Rotating day and night shift work was started to assist the change from manual to automated support procedures, and to maintain normal nautical chart production. Automated charting efforts became a part of the daily activities of each of the eight production teams in the NCB.

The study of chart coverage and maintenance schedules was integrated with updating the long-range nautical charting plan. A study of chart layout and format for the Great Lakes was started. Plans were initiated for the production of four charts requested by the Defense Mapping Agency.

Four international nautical charts covering areas of the Northeast Pacific Ocean and the Bering Sea were issued. Compilation started on the fifth and last international chart associated with the NOS commitment to the International Hydrographic Organization, with chart issue scheduled for FY 1977.

Unique in this Bicentennial year (1976) was the printing of the one-billionth NOAA/NOS chart. The chart, number 12283, of Annapolis Harbor, Maryland, contains appropriate historical facts in narrative form, and an inset showing an 1846 Annapolis Harbor chart (see illustration 8).



8. The One-Billionth Nautical Chart

LORAN-C lines of position were added to 94 NOS nautical charts and LORAN-A lines of position were added to 11 NOS nautical charts during the year. Twelve LORAN plotting sheets were prepared to support projects at the Atlantic Oceanographic and Meteorological Laboratory, the NOAA Ship RESEARCHER, and the NOAA Ship MILLER FREEMAN.

Three small-craft charts (11485, 12271, and 14851) were converted to the "pocket-fold" format. The new format is designed to eliminate production of small-craft chart covers.

A prototype Amphibious Assault Chart of an area in Montague Strait, Alaska, was compiled, printed, and delivered to the Defense Mapping Agency.

At the suggestion of the U.S. Coast Guard, a new buoy symbol was adopted and added to approximately 200 NOS charts.

Raydist plotting sheets were prepared for the State of Maryland, covering 25 Maryland Oyster Bar maps and 11 NOS Chesapeake Bay charts.

The Cooperative Charting Program continued to be active. In CY 1975, in addition to a large amount of individual reporting, 17 U.S. Power Squadrons (USPS) districts and eight U.S. Coast Guard Auxiliary (USCGAUX) districts conducted special volunteer charting investigations. Members of 31 USPS districts and 12 USCGAUX districts participated in the overall program. More than 35,000 credit units were received by the 31 USPS districts, representing the largest number recorded in one year since initiation of the program in 1962. The 5,092 corrective items submitted by 12 USCGAUX districts represented an increase of 109 percent over the number of items submitted in 1974.

#### Computer-Assisted Charting

Development of a computer-assisted nautical chart production system was expanded with creation of the Automated Cartography Group and integration of automated efforts into all teams of NCB.

- o Ninety-six scribed negatives were produced of facility tabulations for 84 charts
- o Three hundred thirty LORAN lattice negatives were scribed for 102 charts
- o Forty-eight Raydist lattice negatives were scribed for the State of Maryland
- o Three negatives for extending mineral lease blocks of three charts of the Gulf of Mexico were scribed
- o One thousand depth tabulations were scribed for 500 charts
- o Ninety buoy negatives were scribed for chart modernization

- o One tidal current base plate negative was scribed
- o One sounding and depth curve negative was scribed for chart 18765

Base Plate overlays for 494 charts were compiled and 226 were reviewed. This makes a total of 595 compiled for 973 charts and 281 reviewed. Of the 378 remaining to be compiled 111 were started.

Thirty-eight Waterway Overlays were compiled and 19 reviewed. Of the 935 remaining to be compiled, 29 were started.

Thirty-eight Navigation Overlays were compiled and 19 reviewed. Of the 935 remaining to be compiled 29 were started.

Four hundred thirty-six nautical charts of the 973 total were updated and reported maintained in continual maintenance. This makes a total of 625 nautical charts in continual maintenance.

A test effort was implemented in Team 4 for the computer-supported maintenance of Aid Proofs from corrections originating with Notices to Mariners. The test plan was adopted and Notice to Mariner application functions will be made the responsibility of all team areas in FY 1977.

The automated production of graphic bar-scales in nautical miles, statute miles, yards, and meter units were developed to assist new chart production and chart maintenance.

A graphic plotting interpolator was developed with assistance from the automation effort for use on conic projection charts.

Detailed specifications for 192 charting features were stated and adopted for use in the automated chart production system. Cartographic codes were specified for each of the 192 symbols.

### Coast Pilots

Aerial photographs of various harbors and other important features in western Alaska were obtained. These photographs will appear in the 1977 edition of Coast Pilot 9.

A field inspection of the area covered by Coast Pilot 4 (Cape Henry to Key West) was completed and a field inspection of the area covered by Coast Pilot 8 (Alaska, Dixon Entrance to Cape Spencer) was started in June 1976.

Responsibility for publishing and editing the Great Lakes Pilot (formerly a function of the Lake Survey Center) was transferred to the Coast Pilot Branch on April 1, 1976.

## Bathymetric Mapping

Twenty Outer Continental Shelf (OCS) Resource Management bathymetric maps were produced under a reimbursable program with the Bureau of Land Management.

A cooperative program for topographic/bathymetric mapping was started between the NOS and the U.S. Geological Survey (USGS) to meet demands for Topo/Bathy maps in support of Coastal Zone Management activities and marine resources development on the Continental Shelf. Shoreline and bathymetry were provided the USGS for four 1:250,000 scale maps during the year.

## General

The Hydrographic Survey Branch and the Marine Requirements Coordination Group were reorganized on February 15, 1976, and established as the Marine Surveys Division under the Office of Marine Survey and Maps.

A study of the 13-color nautical chart printing system was conducted and three five-color prototype charts were produced showing new colors by basic color selection and screening methods. The prototypes will be sent to various marine groups for evaluation in FY 1977.

## Statistics

New conventional international nautical charts. . . . .	4
New special-purpose nautical charts . . . . .	1
Reconstructed conventional nautical charts. . . . .	1*
Maintained conventional nautical charts . . . . .	486**
Conventional nautical charts cancelled. . . . .	1
Reformatted small-craft nautical charts. . . . .	3
Maintained small-craft nautical charts. . . . .	89
Articles published in Notices to Mariners . . . . .	4,703
Chartlets published in Notices to Mariners. . . . .	135
Charts prepared for litigation. . . . .	178
Surveys from non-NOS processed. . . . .	3,229
Coast Pilots - new editions . . . . .	6
Coast Pilots - supplements. . . . .	2
Bathymetric maps. . . . .	20

\* With orthophoto topography

\*\* One was the one-billionth chart issued by the NOS

## Oceanography

The three-year tide and tidal current survey of Cook Inlet, Alaska, was completed and the data processed for dissemination. The entire file of data was recently provided to the Environmental Research Laboratories. A Cook Inlet Data Products Report for Phase I - 1973 and Phase II - 1974 was prepared.

A tide and tidal current survey, the first of a scheduled four-year survey, was begun in Prince William Sound, Alaska. Lack of needed data for that area and an expected heavy increase in commercial traffic necessitated the survey. The tide and tidal current survey of Puget Sound and Approaches continued with focus on the area south of the San Juan Islands. Part of this effort was accomplished through cooperation and coordination with the Pacific Marine Environmental Laboratory and the MESA-Puget Sound Project.

East coast tide and current surveys continued with surveys in Portsmouth Harbor, New Hampshire; Beaufort Inlet, North Carolina; and Cape Fear, North Carolina. Data users include the University of New Hampshire, the National Marine Fisheries Service, and the Corps of Engineers.

Funds were allocated specifically for marine boundary and tidal datum surveys in Florida, South Carolina, New Jersey, and California. Prior to FY 1976 the NOS conducted these tidal surveys with reimbursable and/or reprogramed NOS base funds.

Five new primary tide stations were constructed and seven primary stations were upgraded with new and improved instrumentation within the states involved in the Marine Boundary Program. In addition, 117 new secondary stations and 95 new tertiary stations were established in these states during the year. This involved the processing of 1,749 station-months of tide data and the computation of tidal datums for 217 new locations.

With passage of the 200-mile extended jurisdiction legislation, site selection and preliminary engineering design were accomplished for eight new primary tide stations to support the extended jurisdiction program. Data from these new primary stations are required to accurately delimit the base line from which to measure the 200-mile boundary. This program will add approximately 44 new primary tide stations to the National Tide Observation Network.

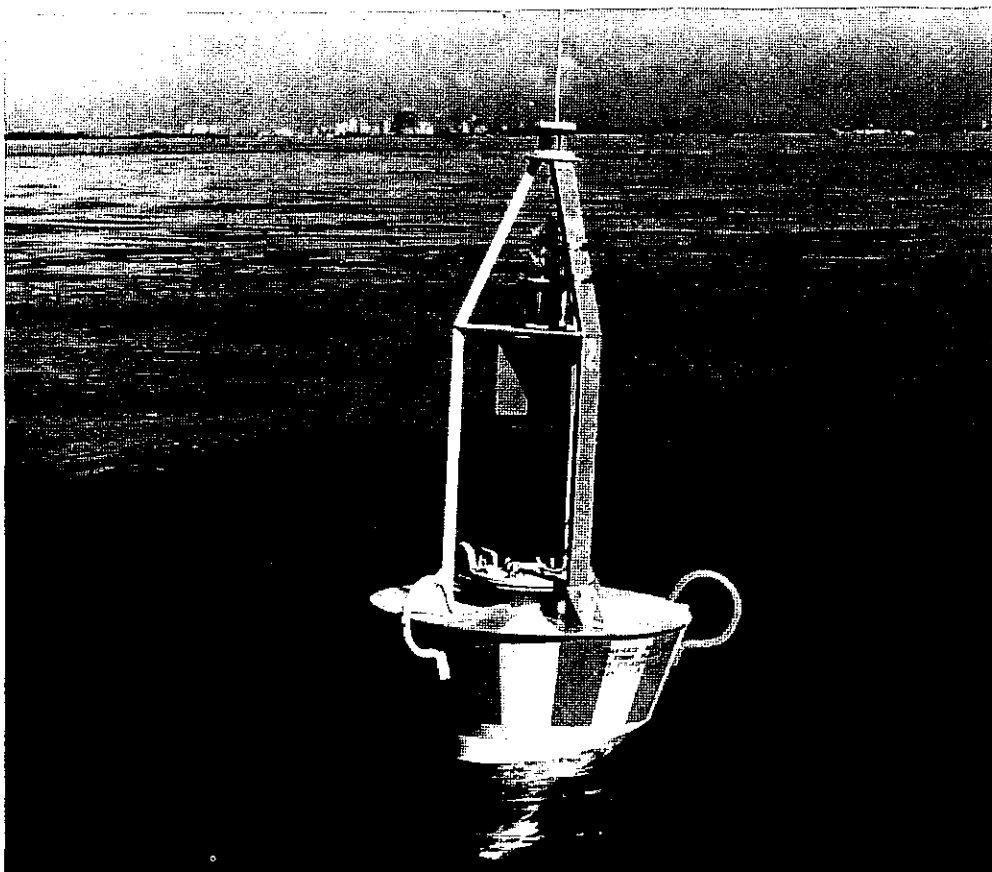
A pilot study to determine the relationship of tidal datums and the upper limit of the coastal marsh was conducted for the Environmental Protection Agency (EPA). The data was published in August 1975.

A program to improve the instrumentation used to acquire tidal measurements was instituted with the support of the Engineering Development Laboratory.

Modification units are presently being tested at 12 tide stations at various locations throughout the United States.

An Automated Data Processing (ADP) system analysis study was successfully initiated to improve data processing techniques. A program was established to accomplish the comparative reading process within 24 hours. Therefore, notice of gage malfunctions and inadequate data can be sent to the field units within a few days of record receipts. When on-line computer capability is established, an anticipated 24-hour turnaround on data processing will be implemented with no further data backlog.

The mathematical model for computing tide correctors for offshore hydrography was verified during the New York Bight hydrographic survey using tide data collected with the Deep Sea Tide Gage (DSTG) and the Offshore Telemetering Tide System (OTTS) (see illustration 9).



9. Offshore Telemetering Tide System (OTTS) Buoy

Further verification of the offshore zoning techniques is being accomplished concurrently with an east coast hydrographic survey. A report to document this new offshore zoning technique was prepared, based on the verification results.

The Great Lakes Water Levels Program management and data analysis functions and personnel, previously located in Detroit, Michigan, were incorporated into the Tides and Water Levels Branch of the NOS Oceanographic Division, Rockville, Maryland. After the successful transfer, preliminary planning commenced on a seven-year program to reevaluate the International Great Lakes Datum (IGLD) 1955. Engineering design and budgetary planning, to construct four new control water level gaging stations, were accomplished.

The vertical control portion of the Great Lakes Water Levels Program supports the determination of water level elevations, gage monitoring, maintenance of the IGLD 1955, and agreements with the Corps of Engineers and the Canadian Government.

## Oceanographic Division Statistics - FY 1976

Tide Tables	4 Publications
Tidal Current Tables	2 Publications
Supplemental Tide Tables - Anchorage, Alaska	1 Publication
Supplemental Tide & Current Tables	
Operation SAIL	1 Publication
Tidal Current Diagrams	2 Publications
Great Lakes Water Levels - 1975	1 Publication
Great Lakes Water Levels - 1860-1975	1 Publication
 Special Tide Predictions for NWS	
Forecast Program	111 Station Years
Special Tide Predictions for Foreign	
Exchange Program	109 Station Years
Special Tidal Current Predictions for	
Foreign Exchange Program	13 Station Years
Quality Control Comparisons of Predicted	
and Observed Tides	41 Station Years
 Tide Records Received	4,008 Station Months
Tide Records Processed	3,756 Station Months
Reduction/Increase of Backlog	+252 Station Months
Total Backlog-End of FY 1976	998 Station Months
 Level Records (Tides) Received	966 Books
Level Records (Tides) Processed	1,213 Books
Reduction/Increase of Backlog	-247 Books
Total Backlog-End of FY 1976	0 Books
 Tidal Datum Zoning and Reducers for	
Hydrography	170 Hydro Sheets
Tide Notes for Nautical Charts	413 Locations
 Tidal Datums Established	
New Stations	250 Station Datums
Redetermined	120 Station Datums
Tidal Datums Published	280 Station Datums
 Harmonic Analysis of Tide Data	
365-Day Time Series	122 Analyses
29-Day Time Series	527 Analyses
15-Day Time Series	2 Analyses
 Water Level Records Received	7,416 Station Months
Water Level Records Processed	7,416 Station Months
Total Backlog-End of FY 1976	0 Station Months
 Level Records (Great Lakes) Received	180 Records
Level Records (Great Lakes) Processed	180 Records
Total Backlog-End of FY 1976	0 Records

First-Order Levels Run	157 Miles
Great Lakes Rain Gage Records Received	8,400 Records
Great Lakes Rain Gage Records Processed	8,400 Records
Total Backlog-End of FY 1976	0 Records
Current Meter Data Received	
NOS Projects	221 Meter Months
MESA N.Y. Bight Project	305 Meter Months
Subtotal	526 Meter Months
Current Meter Data Processed	
NOS Projects	201 Meter Months
MESA N.Y. Bight Project	120 Meter Months
Subtotal	321 Meter Months
Decrease/Increase in Backlog	
NOS Projects	+ 20 Meter Months
MESA N.Y. Bight Project	+185 Meter Months
Total Backlog-End of FY 1976	398 Meter Months
Harmonic Analysis of Current Meter Data	
NOS Projects	354 Analyses
MESA N.Y. Bight Projects	65 Analyses
Non-Harmonic Reduction of Current Meter Data	
NOS Projects	21 Analyses
MESA N.Y. Bight Project	103 Analyses
Archival of Current Meter Data at NODC	161 Meter Months
Surface Water Temperature-Density Data	
Received	900 Station Months
Processed	900 Station Months
Decrease/Increase in Backlog	0 Station Months
Total Backlog-End of FY 1976	0 Station Months
Serial STD Observations	
Received	850 Stations
Processed	106 Stations
Decrease/Increase in Backlog	744 Stations
Total Backlog-End of FY 1976	924 Stations

#### Coastal Mapping

About 11,000 linear miles of metric aerial photography were flown by the two NOAA Photographic Missions. Included was photography for shoreline mapping for Lake Michigan (Milwaukee Harbor and Evanston to Waukegan); for Lake Erie (Buffalo Harbor and Chart 14606); for Cook Inlet, Shelikof Strait,

Icy Bay and Yakutat Bay, Alaska; for Port Hueneme to Point Estero, California; for northern Chesapeake Bay; and for three east coast harbor entrance maps (see illustration 10). Approximately 120 maps were compiled for the Marine Charting Program in support of hydrographic operations.



10. Aerial Photograph of Annapolis Harbor

## Photogrammetric Research and Development

Research and development activities continued to be mainly concentrated in the areas of precision numerical photogrammetry and automation of the photogrammetric processes. A major step in this automation effort was the purchase of an analytical stereoplottting system for delivery by 1978. Work continued on the development of computer software in support of a total program to produce ground positions having conventional geodetic accuracies. The measurement capability of the Coastal Mapping Division was enhanced with the procurement of a digitized stereoscopic plotting instrument. Development continued in the area of sensor calibration by stellar and airborne techniques. A time/cost study of applied photobathymetry was completed.

## Coastal Boundary Mapping Program

Progress continued on the cooperative coastal boundary mapping program between NOS and the State of Florida. A format change, to compile a standard shoreline-type map instead of the published map with an orthophoto interior, was initiated. The unpublished shoreline maps show only a fringe of interior detail. The same accuracy standards remain. Eighteen shoreline-type maps were compiled and final copies distributed to the appropriate Florida offices.

## Photobathymetry and Photogrammetric Tidal Current Survey

Photobathymetry was completed on six maps at Oregon Inlet, North Carolina, and on six maps on St. John Island, Virgin Islands. Photogrammetric contouring utilizing photographs taken just prior to flooding of the Lower Granite Pool Snake River, Washington/Idaho, is being compiled on ten maps. These maps will be completed early in FY 1977.

A photogrammetric Tidal Current Survey was completed in Oregon Inlet, North Carolina. Photogrammetric measurements of current velocities were made of the water surface of the 3- and 10-foot depths.

## Airport Obstruction Program

Field surveys for 162 airports were completed for the Federal Aviation Administration (FAA) and obstruction charts were compiled and published for 156 airports (includes orthophoto background for nine). Additional efforts were required to accurately locate 120 instrument landing facilities and 35 radar navigational facilities. Investigation of procedures for automating and digitizing obstruction data for the FAA continues.

## Storm Evacuation Mapping

Seventeen new NOS/NWS Storm Evacuation Maps were issued. Areas covered: along the Gulf of Mexico from Houma, Louisiana, to Beaumont, Texas; the vicinity of Tampa Bay, Florida. Fifty-five maps in this program are now available.

## Flood Insurance Mapping

Flood insurance studies with accompanying maps for 31 communities (8 counties, 23 cities and towns) were submitted to the Federal Insurance Administration. This completes all of NOAA's studies and production. Except for questions relating to final review by HUD and the communities, the program has been completed.

## Marine Surveys

In July 1975 a "Draft Preliminary Plan for the Modification of the Basic Hydrographic Survey Processing System," outlined planned changes in organization, functions, and interrelationships of the existing processing system, considered necessary to ensure a rapid and balanced response to changing requirements throughout the charting and mapping programs of NOS. The Plan's intention was to have the Marine Centers assume authority and responsibility for the production and processing of hydrographic surveys. This authority and responsibility was promulgated by the Director's memorandum of August 4, 1975. Interim Hydrographic Survey Processing Policies and Procedures were contained in the September 22, 1975, memorandum from the Associate Director, Office of Marine Surveys and Maps. On September 29, 1975, that Office also established the Hydrographic Data Evaluation Group (HDEG) to inventory all surveys not completely processed and evaluate them with respect to the degree of processing to be accomplished. The final HDEG report was transmitted to the Director on January 27, 1976.

The Marine Surveys Division was formally established effective February 15, 1976, to supervise the overall hydrographic and bathymetric survey activities of the Office of Marine Surveys and Maps and to coordinate the oceanographic survey projects of the Office. The Division develops requirements, examines priorities, prepares project instructions, coordinates programs, and monitors surveys for compliance with project instructions, quality standards, and overall program objectives. A detailed analysis and inspection of completed surveys is performed, providing a complete check on data acquisition and field and office processing. Security and storage of original surveys, records, and associated data is provided. Copies of surveys, records, and reports are provided to the public and other government agencies. These functions are accomplished by the three Branches of the Division, (1) Requirements, (2) Quality Control, (3) Data Control.

In Fiscal Year 1976 the Requirements Branch coordinated the effort and monitored progress on 35 projects in support of the Office of Marine Surveys and Maps marine programs. Liaison with Defense Mapping Agency Hydrographic Center, Office of the Oceanographer of the Navy, and the Marine Centers continued during the year.

The SCOPE (Southern Coastal Plains Expedition) products report was completed and distributed to interested parties. The report provides information on available SCOPE projects and procedures for obtaining specific data.

Planning for a five-year multifaceted investigation in the Great Lakes was initiated. This comprehensive survey of the Great Lakes, which will commence in June 1977, is intended to update charted information needed for marine transportation on the Lakes, and to contribute to the economic well-being of the region.

Registration of hydrographic surveys declined sharply during the year because of new verification requirements imposed on the Marine Center Processing Division. A portion of the original surveys and records of the Lake Survey Center archives was received from the Lake Survey Center. Dissemination of copies of hydrographic and topographic surveys to the public and government agencies continued at a high level. To most effectively utilize the new precision camera for copying surveys--obtained by the Reproduction Division, Office of Aeronautical Charting and Cartography--a plan has been developed to send 25 surveys daily to the Reproduction Division for use in making negatives on 210 mm film.

Eight hundred sixty-two copies of surveys were reproduced for official use by the NOS Marine Centers, other NOAA MLC's, and government agencies.

#### Statistics

Project Instructions issued	35
Presurvey reviews prepared	8
Presurvey reviews updated	8
Hydrographic surveys registered	65
Hydrographic surveys verified (HQ)	4
Hydrographic surveys reviewed (HQ)	93
Hydrographic reviews inspected	112
Quality Control Reports prepared	19
Requests for hydrographic survey copies	304
Hydrographic copies issued	1,425
Requests for topographic survey copies	86
Topographic copies issued	356
Geophysical data received	0
Geophysical data disseminated ... 13 cu. ft., 120 ft. microfilm	
Classified documents disseminated (Surveys)	11
Hydrographic and topographic indexes issued	3,099
Certifications issued	192

#### Miscellaneous

Descriptive Reports copies	143
Master diagrams, Xerox 18-60, color coded	202
Stable base media issued	111
OSS sheets issued	440
Backlog surveys for verification ... 3 ea. sent, 23 returned	
Availability information for boat shows	1,200
Freedom of Information Act Requests	0

## OFFICE OF AERONAUTICAL CHARTING AND CARTOGRAPHY

The Office of Aeronautical Charting and Cartography (AC&C) continued its primary mission of producing and distributing aeronautical charts required for the management, operation and use of the National Aviation System. Reproduction and distribution support for other NOAA programs was also provided.

### Training

AC&C personnel attended 209 training courses, of which 57 percent were in science and technology, 29 percent in management and supervision and 14 percent in automatic data processing.

### Management

This was a year of several achievements in the development of new products and the modification and restructuring of others currently on issue. Progress was made in the development of new processes, techniques and systems designed to improve the quality of NOS products and services. Planned program objectives were satisfactorily accomplished.

Contracts were renewed with commercial sources for the negative engraving of Airport Obstruction Charts, Standard Instrument Departure Chart Booklets and the Alaska Terminal Publication. Involvement with commercial contracting afforded an opportunity to evaluate contractor responsiveness in meeting prescribed time schedules, and to evaluate product quality and cost effectiveness. The experience gained through this effort has shown commercial contracting to be a cost effective alternative to inhouse production under limited manpower conditions.

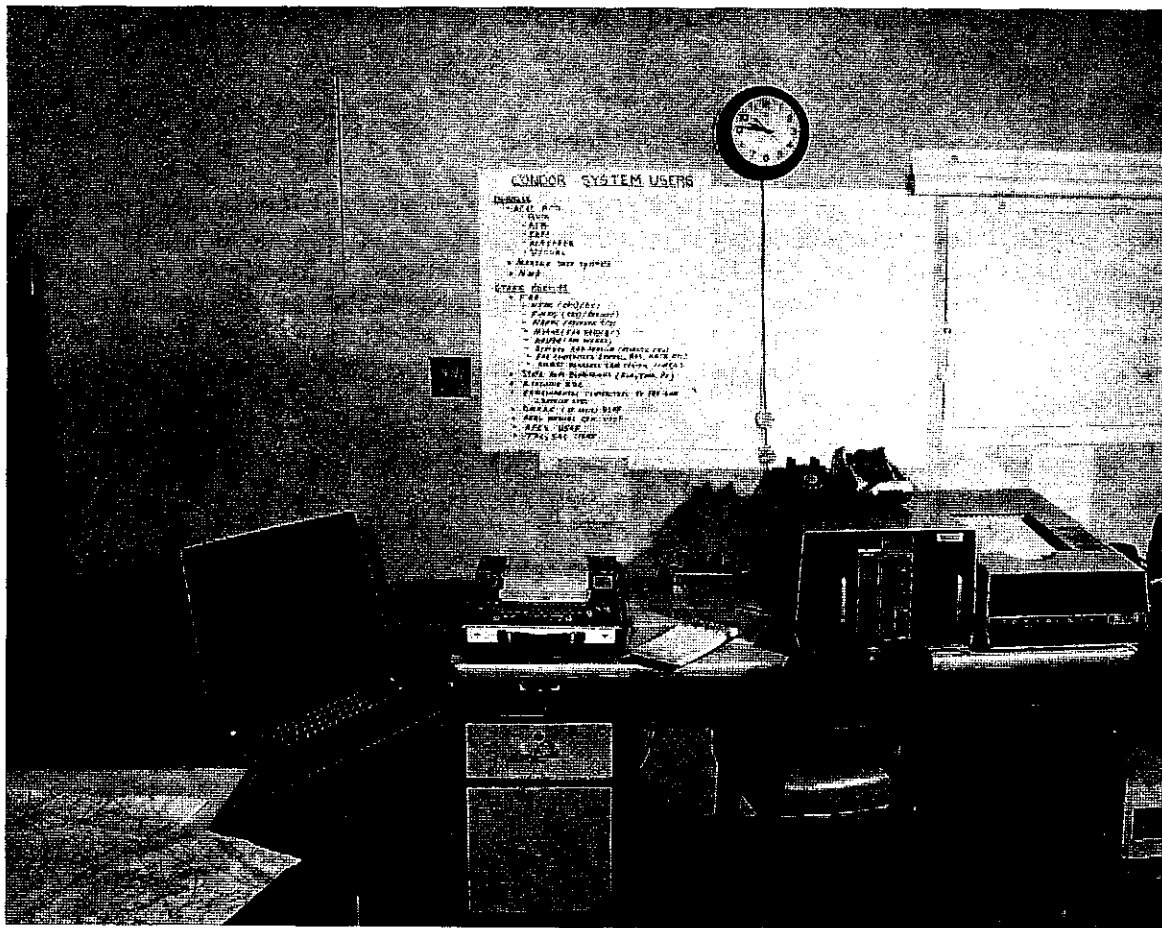
The volume of weekly issues of the Instrument Approach Procedure Charts, coupled with the impact on workload in the Distribution Division (a result of the change to the 56-day amendment cycle) prompted a feasibility study for converting existing manual/machine systems to a completely mechanized system. A contract was awarded to Dynatech Research and Development Corporation for a mechanized system-design for packaging and distributing subscription charts. The system design, completed and delivered, is under consideration pending outcome of the bound IAPC project.

To provide ADP support for the clerical, administrative, financial and statistical functions of the Distribution Division, an analysis of the work and its related processes was made by an inhouse study group. The study recommended the development of a multi-phase system by which these processes could be automated. A contract was awarded to Creative Mailing Consultants of America to design the system and implement the first phase. Final design specifications were delivered in June 1976. The contract for the completion of phases II through IV was awarded in June and completion is expected in December 1977.

A plan for the reorganization of the staff of the Associate Director, Aeronautical Charting and Cartography, was developed and processed for re-

view and approval. This reorganization is designed to provide additional manpower and expertise necessary for effective overall management of production programs and resources of AC&C. The control and coordination of chart production was elevated to the staff level. This staff function was established to coordinate chart production among the three divisions of AC&C and the Marine Chart Division. It will also provide management with a daily overview of the status of chart production, an insight to the problem areas involved, and a focal point for the determination of aeronautical charting requirements and the assessment and introduction of advanced technology in the chart production process.

The Computationally Oriented National Data Optimum Retrieval (CONDOR) System was installed on the FAA National Flight Data Center computer at Oklahoma City, Oklahoma, and is operational. The FAA displayed the system at the Federal Bicentennial Exhibit held at the Kennedy Space Center, Florida, in May 1976. The interface between the Data Management Subsystem and the Prototype Graphic Subsystem was successfully tested. This interface allows the graphic display of the information in the data base.



11. Computationally Oriented National Data Optimum Retrieval System (CONDOR)

The Labor/Management agreement between the NOS Director and the National Alliance of Postal and Federal Employees (NAPFE) Union, Local 209, was signed on December 12, 1975. The agreement remains in effect for a period of three years.

Follow-up audiogram tests for all employees of the Reproduction Division were completed during the latter part of FY 1976. This once-yearly review will reveal any individual whose hearing may have become impaired during the past year. With the acquisition and distribution of protective devices immediately following FY 1975 testing, deficiencies are expected to be minimal. Annual tests will provide information to effect immediate remedial action.

The responsibility of the Aeronautical Charting Automation Project (ACAP) was transferred to AC&C when the Chart Automation Project Office was abolished. The ACAP Program Development Plan was revised for submission as the issue paper to support the request for FY 1978 funds and as the feasibility study for the implementation of an automated aeronautical chart production system in FY 1982. Associated with this project was the acquisition of a prototype graphics compilation station for Radar Video Map production. Evaluation results of this prototype station will be used to prepare specifications for an operational system.

### Reproduction

Press plate and reproducible material pin registration tests and experimental press runs were successfully performed to test the utility of prepunched film and press plates on the five-color Harris Press. The tests demonstrated significant man-hour savings in the make-ready function of the printing process. As a result, a working group was established to work on a long range project to improve registration of materials throughout the reproduction process for all products.

Nautical charts are now being printed in a five-color format. The Office of Marine Surveys and Maps coordinated on the use of the new printing process for future editions of all nautical charts. Considerable savings in press time for those charts requiring more than five colors will result from this technique.

A group of students from the Metropolitan Washington School of Printing, Montgomery Community College, toured the Reproduction Division on May 6.

### Aeronautical Products

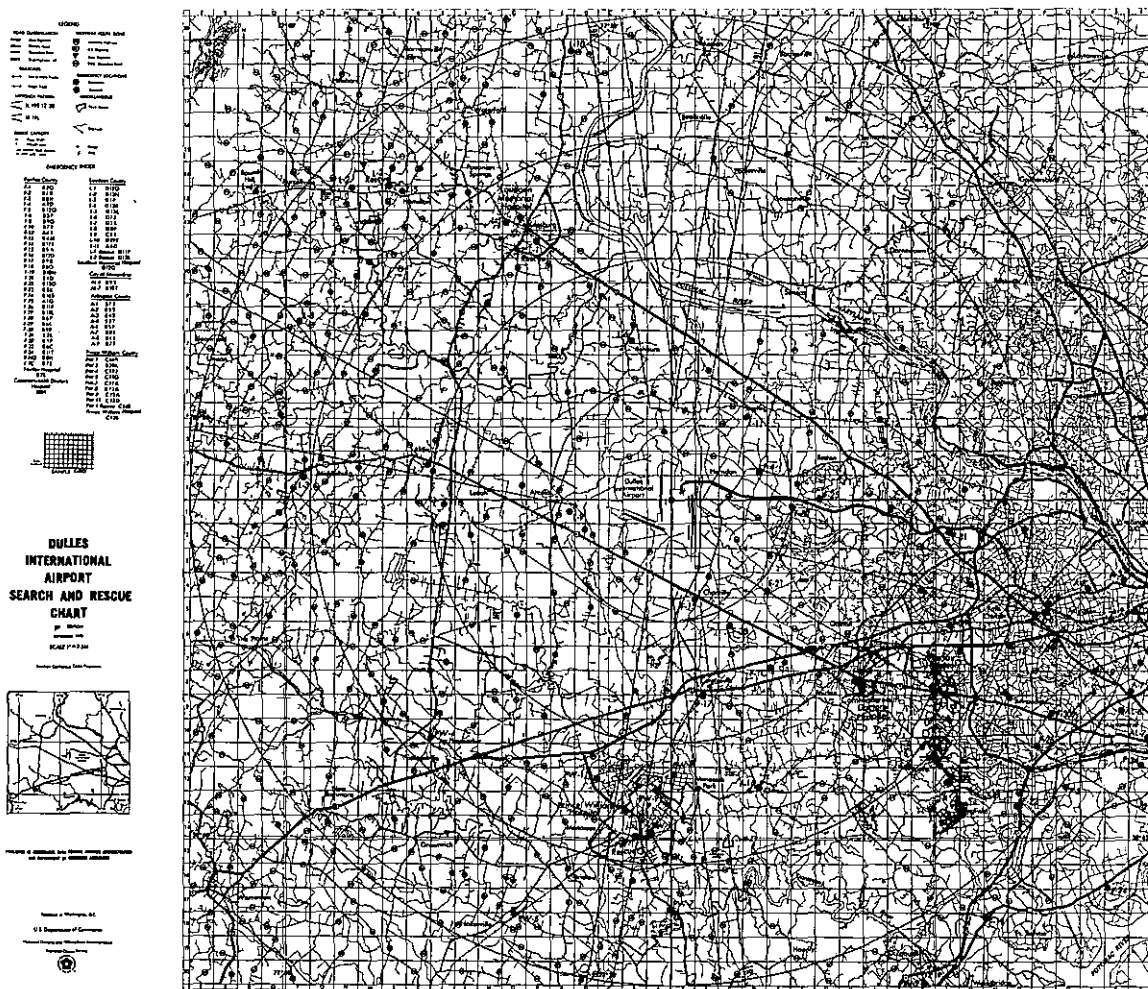
During January, the 1975 and 1980 magnetic declinations for all navigation aids depicted on NOS products were computed for inclusion in all future aeronautical charts and publications. Master overlays for the 1975 Epoch Isogonic curves of magnetic variation were drawn for all NOS products.

## Production

Over 4,000 Instrument Approach Procedure Charts (IAPC) were issued and maintained during the past year. Three hundred and fifty-four new charts were added and 133 were dropped from this chart series. A total of 2,328 was furnished to the Defense Mapping Agency (DMA) Aerospace Center under the provisions of the NOS/DMA interagency agreement. Currently, there are 4,035 IAP Charts operationally in use serving the civil aviation community.

Twenty-four prototype IAP Charts depicting terrain avoidance information were provided the Federal Aviation Administration (FAA) for test and evaluation. Overlays of shaded relief and maximum terrain elevations within a radial grid were depicted on several prototypes.

The Dulles International Airport Search and Rescue Chart was designed, compiled, printed, and delivered to the FAA and to the Dulles Fire Department for operational use in emergencies. Follow-on editions will be based on an "as required" need (see illustration 12).



12. Dulles International Airport Search and Rescue Chart

The Second Edition of the IACC Sectional Specifications, dated February 1975, was implemented on all Sectional and Terminal Area Charts issued. This was a major production accomplishment for the Visual Chart Program.

The Alaska Planning Chart was developed and a format designed for the FAA. Four color proofs were furnished to the FAA for field evaluation. The chart design is similar in concept to the Flight Case Planning Chart covering the conterminous U.S. It is contemplated to be introduced as an operational product during FY 1977.

The Aeronautical Chart Catalog format was reorganized into a book 5" by 10" and will be published each February. It is provided free as a public service to the civil aviation community.

Through the purchase of a Duo-stat self-contained camera and dark room, significant improvements in aeronautical chart production were made. Its uses include: (1) as a compilation aid in the preparation of airport layouts for IAP Charts (2) master graphics for Radio Facility Charts (3) the reduction of quadrangles for the Visual Chart Program.



13. Duo-Stat Self-Contained Camera

The Reduction/Blowback Camera is now producing the hydrographic survey sheets to the 210 mm format at the rate of 25 per day. Although quality of the product is vastly improved over the old system, other lenses from Germinor and Nikon are being tested for further improvement in quality and increased speed of copy produced. Some work was done on request for Litigation Chart copies. Other areas of use are still being explored. Promising possibilities include the full size Topographic Negative file and the Obstruction Chart negative file reduced to the new format.

#### PRODUCTION DATA

(FY 1975)		Total Copies	Total Copies
<u>Products</u>	<u>Charts</u> <u>On Issue</u>	<u>Of Charts</u> <u>Produced</u>	<u>Of Charts</u> <u>Issued</u>
<u>Aeronautical</u>			
Visual	100	2,920	2,278
Instrument	2,834	27,244	20,047
Related Data	N/A	13,249	13,208
<u>Nautical</u>			
Charts	953	2,750	2,072
Publications	17	195	131
Related Data	N/A	2,162	1,820
 (FY 1976)			
<u>Aeronautical</u>			
Visual	105	3,031	2,357
Instrument	3,138	23,326	17,080
Related Data	N/A	12,796	12,795
<u>Nautical</u>			
Charts	954	2,694	2,073
Publications	18	296	144
Related Data	N/A	1,853	1,752

#### Special Products for the FAA

The FAA continued to be furnished with special products and services required for management of the National Aviation System. This included 48 Controller Charts and four Controller Chart Supplements, revised and issued on a 56-day cycle, and four Controller Chart Supplements revised and issued once during the year. One hundred and thirty-two Aeronautical Video Maps were constructed and furnished to the FAA, along with 846 revisions. Other products and services included Central Altitude Reservation Plotting Charts, Defense Readiness Overlays, Budget Overlays, Airman's Information Manual Graphics, Olive Branch Charts, and Airport and Airspace Diagrams. Special products and services were furnished on an "as requested" basis.

The Gulf of Mexico Controller Chart, reconstructed to regular Controller Chart (CC) specifications, was published with an October 9, 1975, effective date. With this printing, the CC program for the Caribbean/Gulf of Mexico area is completely covered. The program consists of three new charts and two reconstructed charts: Panama Area, Panama Terminal and Gulf of Mexico, and Miami/Jacksonville and the San Juan areas.

In support of the noise abatement studies being conducted for the Washington National Airport, the FAA requested 35 mm slides of a marked-up road map of the Washington, D. C. area showing proposed arrival and departure routes, lithographic prints of the Washington National Airport Noise Abatement Procedures Terminal Area Graphic Notice, and a revised Washington National Airport Visual Approach Chart.

A plot of approximately 380 DOD VFR Low Altitude Military Training Routes was prepared by the Gerber Automated Plotter. The finished plot was in ink on .007" stable base matte film to overlay the FAA 1:60 Nautical Mile U.S. Outline Map. The request required a chart suitable for publication in Part 4 of the Airman's Information Manual.

## Public Sales

### Program

Total copies of products produced and issued have declined, while revenues from sales have dramatically increased. Comparing sales of products between FY 1975 and FY 1976 within several basic programs we find:

- . Visual Aeronautical Charts increased by 15%
- . Instrument Aeronautical Charts decreased by 11%
- . Nautical Charts decreased by 5%
- . Nautical Publications decreased by 3%

Despite the general decline in the number of copies sold, revenues from these sales increased from \$4,272,831 during FY 1975 to \$5,901,045 in FY 1976.

Prices of publications were reviewed shortly after the beginning of CY 1976, resulting in some small increases in prices of low-volume products. Another price review will be made during the fall of 1976, with the objective of issuing a new price list on January 1, 1977, effective for CY 1977. No price increases are expected. However, some prices may be decreased.

PUBLIC SALES DATA

	<u>FY 1975</u>		<u>FY 1976</u>	
	<u>Copies</u>	<u>\$ Issue</u>	<u>Copies</u>	<u>\$ Issue</u>
	<u>Issued</u>	<u>Value</u>	<u>Issued</u>	<u>Value</u>
<u>Aeronautical</u>				
Visual	1,548,113	1,252,797	1,786,787	2,073,647
Instrument	15,420,412	1,148,526	13,792,541	1,086,175
<u>Nautical</u>				
Charts	1,284,872	1,652,190	1,226,227	2,353,124
Publications	103,786	163,716	99,941	274,154

SUBSCRIPTION SERVICE

Paid Public Subscriptions	67,924	57,202
Paid Public Subscribers	34,392	28,745

PROCEEDS FROM CHART SALES

<u>1975</u>	<u>1976</u>
\$4,272,831	\$5,901,045

AUTHORIZED CHART AGENTS

	<u>1975</u>	<u>1976</u>
Aeronautical	1,788	1,899
Nautical	1,590	1,651

## OFFICE OF PROGRAM DEVELOPMENT AND MANAGEMENT

A new staff function for ADP management was established to facilitate overall coordination of all automatic data processing within NOS. The objectives of OPD&M, in this regard, are: (1) to assist managers in achieving program goals through effective use of ADP; (2) to coordinate the NOS ADP effort to achieve compatible and coherent systems, to the extent desirable; (3) to serve as the principal source of information about all software systems; (4) to coordinate and assist in the development, utilization, and evaluation of ADP resources.

A contract was awarded to Booz-Allen Applied Research of Bethesda, Maryland, to conduct a 6-month study of the engineering support structure of the National Ocean Survey. The study's purpose is to analyze the engineering support needed by NOS, to assess existing engineering assets and their effectiveness, and to develop recommendations for bringing engineering capabilities up to the level of the projected needs. The end products of this study will include: an assessment of current engineering support assets and capabilities; an evaluation of NOS practices for identifying engineering support requirements and personnel utilization; organization alternatives; recommendations for meeting projected engineering needs; rationale for the preferred organizational alternative and the associated manning levels by engineering discipline, experience levels, and competence.

A number of NOS organization changes were accomplished during the year including: (1) Office of the Director - abolishment of the Chart Automation Projects Office (CAPO) and the Aeronautical Chart Automation Project (ACAP); (2) National Geodetic Survey - abolishment of the Evaluation and Adjustment Section of the Vertical Network Branch, Control Networks Division, with functions transferred to Branch level; (3) Office of Marine Surveys and Maps - abolishment of the Marine Requirements Coordination Group, Hydrographic Survey Branch, Evaluation Section and Hydrographic Section (within the Marine Chart Division, the Chart Planning and Technology Group, and Automated Cartography Group were established; a Marine Surveys Division was established with the following branches: Requirements Branch, Quality Control Branch, and Data Control Branch); (4) Atlantic Marine Center, Coastal Mapping Division - organization change in the Field Surveys Branch; (5) Closure of Lake Survey Center which involved the realignment of existing LSC positions and the coordination and transfer of the functions to the National Geodetic Survey, the Office of Marine Surveys and Maps, and the Atlantic Marine Center.

To implement the Privacy Act which became effective September 27, 1975, a complete inventory of all records of personal information gathered by NOS was made. There are no records systems in NOS which are subject to the Privacy Act. Implementation of the Privacy Act has had little impact on the amount of personal information collected. Operating officials report they are no longer maintaining files of prospective applicants. Copies of personnel actions and some unofficial personnel folders are no longer maintained.

There was one request for information under the Privacy Act, and three requests for information under the Freedom of Information Act.

Two management studies were conducted: a study of the Office of Marine Surveys and Maps placed emphasis on organization structure, systems of operation, management and administrative methods; a study conducted at the Atlantic Marine Center emphasized the administrative management of the Center.

The National Ocean Survey initiated 2,283 new requests for personnel actions and processed 2,211 actions, including holdovers from FY 1975.

Twenty-three employees were nominated for DOC and NOAA medal awards, Outstanding Federal Woman awards, and other citations; 248 employees received Outstanding Ratings. There was one unsatisfactory rating.

Activities in various employee development programs in NOS included the following: (1) 13 positions in the Upward Mobility Training Programs were approved by NOAA for FY 1977; (2) in the FY 1976 Upward Mobility Program, four employees entered the Scientific Technician Program, three entered the Administrative Technician Program, and one entered the Administrative Trainee Program. Employees complete the program one year from entry date; (3) 36 students participated in the Co-op Training program, 12 of which attend local universities and colleges; (4) four employees were trained as instructors for the NOAA Defensive Driving Course; (5) an NOS Management Development Program was developed for implementation in FY 1977. In addition, a recruiting trip was organized to visit colleges and universities in the Southwest with a view toward minority employee recruitment.

The NOS Operations Manual is in the process of revision and seven directives were completed in FY 1976.

Development of the Introduction and Resources, Accomplishments, and Plan of Action portions of the NOS National EEO Affirmative Action Plan for 1976 were completed. Local EEO Affirmative Action plans were developed for the Atlantic and Pacific Marine Centers. NOS endorsed and distributed the Handicapped Veterans Readjustment Appointment Affirmative Action Plan.

The ADP statistical system format reflecting the status of women, minorities, and non-minorities by organizational segment was revised and tested. The new format will provide NOS supervisors, managers, and EEO Committee members with more specific delineations of minority and non-minority women. Statistical summaries were developed and presented to NOS managers and the NOS EEO committee.

NOS employees in the headquarters and field areas received EEO related training. Fifty-four NOS supervisors attended the three-day seminar, "EEO and the Supervisor." One-hundred seventy-one non-supervisory employees participated in the one-day seminar, "Focus On Understanding." To better acquaint NOS EEO Committee members with their duties and responsibilities, a one-day seminar was presented entitled "EEO and the Committee." Thirteen NOS supervisors and managers attended the NOAA Counseling Workshop to improve basic communication skills necessary to provide adequate counseling for employees with problems.

Eleven NOS employees were nominated for EEO recognition in the Martin Luther King commemorative issue of NOAA Week. Five NOS employees were nominated for DOC EEO recognition for outstanding contributions over and above the normal scope of the Department's EEO program.

Ten women in NOS received special recognition for their increasing contributions to the NOS mission during International Women's Year.



14. The OMRON CRT Terminal, used for updating and retrieval of administrative and personnel data.

#### Scientific Services

An inventory of common-use ADP software within NOS was forwarded for inclusion in the Federal Software Exchange Catalog to be published by the Federal Software Exchange Center, General Services Administration.

Descriptions of Micrographic Systems used in NOS were sent to the Office of Management and Computer Systems, NOAA. The Federal Micrographics Council, GSA, is establishing a master file for the exchange of information on micrographic techniques, applications and systems, which will be available to all users.

The Computer Software Report for Spatial Data Handling from the U.S. Geological Survey was reviewed.

Program ALRTEX was modified for the Gravity, Astronomy and Satellite Branch, NGS. Assistance was given to the Staff Geographer, NOS, in producing

computer generated overlays of 200-nautical mile arcs in the Gulf of Mexico on NOS Chart 411 and the United States-Mexican West Coast Boundary on N.O. Chart 18000.

Monthly reports of activities within the ADP Planning and Programming Branches were coordinated. Weekly status reports on NOS usage of the NOAA computers at Suitland and Page, terminal hardware downtime and documented complaints of NOS users regarding system software failures were sent to OMCS, NOAA.

Assistance was provided to the National Geodetic Survey in preparing feasibility studies to digitize vertical control descriptive data and to acquire a cartographic system. These studies supported the FY 1977 Budget.

The Office of Marine Surveys and Maps was assisted in preparing feasibility studies to acquire a stereo-plotter system and to convert tidal data from documents to magnetic tape; in preparing FY 1976 and FY 1977 Tidal Data Plot Diagrams from Long Island Sound, Lower Chesapeake Bay and Boston Harbor; and in selecting the vendor for the National Charts Automation System.

A survey of NOS ADP activities as well as monthly, quarterly and annual reports for ADP management were completed.

In addition, the following studies and documents were reviewed:

1. NOAA/Seattle Telecommunications requirements study.
2. Feasibility study to upgrade the NOAA/Georgetown Computer Facility.
3. Proposed OMB Major Systems Acquisition Circular.
4. Feasibility study to upgrade AMC Computer/Plotter System and acquire Digitizing System for AMC and PMC.
5. Simulate the CDC 6600 update facility on the IBM 360/65.
6. Output Tidal Data Diagrams on the FR-80 COM Device.
7. Aid in the analysis of Aanderaa current meter data.

Members of the ADP Planning Branch attended the Commerce Advanced Management Seminar, Model 204 Data Base Management System Class, NOAA System Analysis and Design Course, FR-80 Programming Class, and the ADP Procurement Seminar.

The Chief, ADP Programming Branch served on the Technical Review Board for the selection of a replacement computer to upgrade the Page site.

The Tides Automation Project Team was formed in September 1975, to analyze the existing tidal processing system and to develop software to satisfy overall ADP requirements. Phase I, consisting of four programs, is in operational use by the Tides Processing Section.

In-house ADP training using audiovisual equipment and texts from Deltak, Inc., began in November 1975, for employees who use the IBM computers. A schedule of nine courses was set up; some courses were offered every other month. A total of 90 employees completed the courses (see illustration 15).



#### 15. ADP Training Room

The Marine Field Support Group completed six utility subroutines and modified 14 programs in the HYDROLOG/HYDROLOT System. Eleven programs were written for the Source Data Collection System for the Reproduction Division, Office of Aeronautical Charting and Cartography.

NOS users of TSO (Time Sharing Option) on First Data Corporation, Waltham, Massachusetts, have three ports available to them. A time-sharing program for maintaining NOAA Ship Schedules was completed and is operational in the Office of Fleet Operations. The NOS telephone directory is also maintained and updated under TSO at First Data Corporation.

The Office of the Staff Geographer prepared lists of approved names for 59 hydrographic survey sheets and 16 Coastal Mapping Projects. In addition, final names editing was provided for 19 shoreline maps. Three nautical charts were also given names editing: 14820 - Lake Erie, 17368 - North Keku Strait, Alaska, and an extension for 13213 - New London Harbor. Eight preliminary name sheets were prepared for two project areas for field investigations of geographic names.

Over 1,200 advance copies of U.S. Geological Survey quadrangles were received and reviewed. This process detected over 100 corrections either on the quadrangles or on NOS products. In keeping with the Division's program of maintaining current records, over 540 new Geographic Name Standards

were made for nautical and aeronautical charts. Name Standards were also made for Coast Pilots, Tide Tables, and Coast Guard Light Lists.

Inquiries about, and requests for, geographic names and geographically related features were answered by approximately 50 letters, and an indeterminate number of telephone calls; computer-generated overlays depicting the 200-mile economic zone in the Gulf of Mexico and the area of the Mexico-United States Border in the Pacific Ocean were furnished to the Department of State; the National Marine Fisheries Service was also supplied with maps showing the 200-mile limit for the entire U.S. coastline, including Alaska; consultation was given to the Department of Justice regarding the Maryland-Virginia boundary in Chincoteague Bay; boundary information between New York-Connecticut in Long Island Sound was furnished to the Coast Guard. Thirty-one new editions of Territorial Sea and Contiguous Zone Maps were prepared and sent to the Department of State for verification, of which twelve were printed.

Approximately 1,100 items were added to the Division's card file of the Board on Geographic Names decisions. As a result of Board decisions, direct liaison with USGS, public response and office research, some 532 geographic names were altered on NOS products.

Maps, charts, and photographs from state and Federal agencies were received totalling 83,936, of which 50,297 were distributed for NOS and NOAA operations and 29,868 were superseded (replaced with updated material). Aeronautical charts were distributed, at an average, to 20 states and nine agencies per month on an automatic exchange basis. Source material and new material indexes were furnished for 190 aeronautical chart revisions. Nautical and aeronautical charts published by NOS were sent to the National Archives and Records Center on a semi-annual basis.

The surplusing of nautical charts more than ten years old resulted in the transfer of 120 sections of map file cases and 12 sections of shelving to the Property and Supply Branch. The space gained was transferred to the Engineering Development Laboratory.

NOS Bicentennial plans developed into a number of significant events including the opening, on February 10, 1976, of the agency's Display Center featuring 169 years of NOS history. The Center will be a "living" exhibition with continuous modifications to keep abreast of highlights in the various NOS disciplines' program activities (see illustration 16).

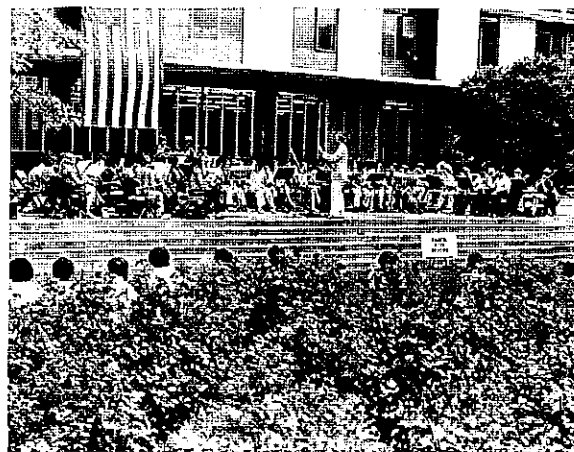
Nearly 9,000 engraved copies of 19th century nautical charts were sold during the first 90 days of the Bicentennial Early Nautical Chart Program. Lithographic reproductions continue to draw sales attention with over 3,500 prints distributed to date.

The NOS Bicentennial Advisory Committee, chaired by the Chief, Physical Science Services Branch, provided coordination for such events as the ACSM/ASP Convention in February 1976, with an exhibit depicting the history of surveying and mapping. The Committee also coordinated a Bicentennial Serenade by the Kensington Junior High School Band for an

audience of NOAA employees, May 1976 (see illustration 17); a mobile exhibit of geodetic survey history; participation in the Congressional Bicentennial Expo held at the Rayburn House Office Building, April 1976; and an exhibit at the "Bicentennial Information Way Station," operated by the nonprofit New Spirit of '76 Foundation in Washington, D. C., March 1976. The proposed Bicentennial interagency national mapping exhibit "Americans and Maps" did not materialize due to a lack of funding.



16. The NOS Display Center



17. Bicentennial Serenade

Programs were prepared for the visits of officials and dignitaries from several foreign countries; arrangements were also made for tours by students from various schools as well as individual groups (see listing of visitors, appendix).

Over 8,000 public requests were processed as part of a continuing effort to provide a specialized user information service. Across-the-counter sales at the Rockville Sales Office totalled \$12,887.22. Nautical charts totalling 4,290 and 4,528 topographic quadrangle maps were distributed to various offices within NOS and NOAA. One-hundred fifteen charts were furnished for court cases as a result of litigation action. In accord with exchange arrangements between NOS and the International Hydrographic Organization, 784 charts were received and 125 charts were sent to various foreign countries.

Consultation was provided the Oceanographic Division for the adoption of a uniform tide station numbering system. Records control and maintenance responsibility for archival records was transferred from the Lake Survey Center. NOS field and office reports totalling 2,876 were registered

including 1,777 tide rolls (marigrams), 88 Ship's Field Reports, 370 Ship Deck Logs and 159 Engineer Logs. Over 1,000 loans and information from NOS current records were processed. NOS borrowed 405 documents from, and returned 491 items to, the NOAA Holding Area/Federal Records Center. Approximately 180 cubic feet of inactive records were transferred to the NOAA records staging area, Federal Records Center.

The NOS Publications Program was prepared and coordinated with an operating budget of \$102,000. A subseries of NOAA Technical Reports, NOAA Technical Memoranda, and NOAA Technical Manuals was requested by the National Geodetic Survey (NGS) and approved by the Environmental Science Information Center in November 1975. The purpose of the subseries: rapid public dissemination of reports and other information prepared by NGS relating to the readjustment of the North American Datum. Six publications in this format were issued in FY 1976. A pamphlet entitled Summary of National Ocean Survey Technical Publications and Charts was published, presenting a compilation of NOS publications and charts, and providing prices, availability and ordering information.

Basic procedures for an NOS Print Media Program were developed and approved for minimum initial implementation. The Print Media Program's purpose: to better serve the public by conveying NOS information to user groups and interested citizens through selected magazines and periodicals.

Scientific, technical and professional papers, cleared for publication or for oral presentation, are listed in the appendix. The NOS Reports (Annual, Monthly, Weekly) were compiled for printing.

The NOS Safety/Security Management Program documented 110 accident reports, 20 incidents of loss or theft, and one fire. Three fire drills took place. Floor Warden Emergency Cabinets containing materials to assist in the evacuation and safety management of employees during an emergency were installed at strategic locations throughout NOS-occupied buildings. Guard service for Buildings 1 and 2 was revised to include day time surveillance as a measure to decrease theft. The NOS Contingency Plan for Emergency Operations, part of the NOAA Emergency Readiness Program, was prepared and issued to each employee as a guideline in the event of a national emergency or natural disaster.

### Program Development

The Program Development Division continued to carry out its coordination and assistance mission, aiding in the development of short-term and long-term NOS program plans. Implementation of all program planning phases of the Fiscal Year Program-Budget Cycle, in accord with NOAA guidelines and schedules, is a principal function of the Division. The Division also monitors the progress of NOS programs by operating the NOS Management-by-Objectives (MBO) program; conducts analytic studies in support of NOS programs; acts as the principal point for information on NOS programs in response to NOAA requirements and outside requests; reviews reports, including Environmental Impact Statements prepared by outside organizations; provides the Director with general staff support.

The most important events in the Program-Budget Cycle include the preparation of the Director's presentation of NOS FY 1978 Plans to the Administrator; formal submission of the FY 1978 Budget to NOAA; preparation of supporting Issue Papers, and their subsequent submission to NOAA; coordination of NOS answers to questions from the Department of Commerce concerning NOS budget requests. The Issue Papers covered the following subjects: aeronautical chart automation, optimum fleet utilization, vessel replacement, fleet electronic maintenance, AMC expansion, pollution abatement, nautical chart automation progress, bathymetric mapping, releveling of the vertical network, and geodetic data bank.

The Division's MBO operation monitors the progress of NOS programs toward stated goals. Monthly MBO status reports, and modified Gantt charts and visual aids--prepared for selected projects to evaluate attainment of milestones--were presented to the Director of NOS and the Associate Administrator for Marine Resources. Monthly progress reports on EPA pass-through programs were also prepared and submitted to the Associate Administrator for Environmental Monitoring and Prediction.

In conjunction with the modified Gantt charts, the Significant Projects Internal MBO Monthly Status Report performs an integral function in monitoring the progress of NOS programs. This detailed report was issued monthly to the Director and Associate Directors, informing them of progress and/or problems concerning significant projects.

Quarterly program evaluations were prepared and presented to the Director and Associate Directors for all program areas. These presentations included the milestone status by objective of all NOS programs, including the accomplishments and status of resource allocation by objective. This program matches actual dollar obligations with accomplishments and provides the Director and Associate Directors with an overview of NOS program status. To refine the system with dollar obligations all FMC's were requested to match task numbers with NOS objectives for FY 1977.

Analytic studies were carried out to review NOS operational procedures, user needs, and NOS goals and objectives. These studies resulting in recommendations for program improvements to the NOS-U.S. Power Squadrons-U.S. Coast Guard Auxiliary Cooperative Charting Program, Potential Recreational User Demand for NOS Nautical Charts, and Conversion of the Aeronautical Charting IAPC Program to Bound Volume, Commercial Contract Production.

Additional support was provided the NOS program areas in the preparation of a program development plan and a cost operations plan for the "Marine Boundary and Tidal Datums Surveys Program," and in the updating of the "Memorandum of Understanding between the FAA and NOS on Aeronautical Chart Products." Assistance was provided in the preparation of "Progress Report on Nautical Charting Automation," and on the preparation of a program development plan for the "Two-Hundred Mile Extended Jurisdiction Boundary Program."

A new staff support project was prepared and distributed to NOS management and planners in the form of a set of "Program Handbooks," describing each NOS program in terms of mission, statutory authority, organization, functions, operational procedures, requirements, inputs, outputs (products and services), resources, needed program improvements, and dependencies on other NOS/NOAA programs. Current information will be reflected in the "Program Handbooks" through periodic revision.

In its capacity as focal point for NOS program information, the Division responded to many requests from a variety of organizations and agencies including Congressional Committees, the Energy Research and Development Administration, and NOAA components--i.e., the Management Analysis Division (productivity measurements); MESA (NOS activities in the Puget Sound area for design of a brochure); International Affairs (NOS international programs); Programs and Budget (R&D classification, National Atmospheric Science Program, NOS energy-related programs); Marine Resources (program evaluation summaries, speeches by Commerce officials); Environmental Monitoring and Prediction (ocean services development plan); National Environmental Satellite Service (NOS space-related programs); General Counsel (proposed legislative program).

The Division, representing NOS on NOAA Interagency Coordination Committees, provided the NOS input for the "FY 1977 Federal Plan for MAREP" prepared by the Interagency Committee for Marine Environmental Prediction, and the "Federal Ocean Program" prepared by the Interagency Committee for Marine Science and Engineering.

In response to NOAA's Office of Ecology and Environmental Conservation, 198 Environmental Impact Statements were reviewed. Other reports reviewed include the "Environmental Assessment Plans for Oil and Gas Development in the Gulf of Mexico and the South Atlantic" prepared by the Bureau of Land Management, and the "Coastal Zone Handbook" jointly prepared by NOS and the U.S. Geological Survey.

Examples of general staff support provided to the Director of NOS include:

- o "Determining Baselines for Offshore Boundaries" -text and slide presentation prepared for 1976 Offshore Technology Conference, Houston, Texas
- o "The National Ocean Survey--The Government's First Technical Agency" -text prepared for the 1976 ACSM-ASP Convention, Washington, D. C. (A 100-page historical document was also prepared in connection with this convention)
- o "The National Ocean Survey and Its Mission" -text prepared for the Society of American Military Engineers meeting, Vicksburg, Mississippi

Other support activities included a study of NOS-Coast Guard relationships, preparation of a "Fact Sheet" on Boston Harbor Current Charts, collection of background information for the Director's appearance at a briefing for the Secretary of Commerce, and the preparation of two articles for the Military Engineer magazine ("Atlantic Seaboard Area Project," and "NOS Water Circulation Studies"). The Division also provided the staff support needed for the collection of NOS input for updating the Canada-United States Mapping and Charting Plan, and for participation by the Director's representatives at the Canada-United States Mapping and Charting Committee Meeting held in St. Louis.

A Division member participated in the Marine Affairs Program at the University of Rhode Island during the 1975-1976 academic year on full-time training.

### Program Management

The Program Management Division, in cooperation with the Program Development Division, established an effective relationship between NOS operating tasks and the objectives contained in the Management-by-Objectives (MBO) program. MBO has been brought into line with tasks on a dollar basis. Certain refinements will take place periodically.

A 10-year history of Operations, Research and Facilities--Operations Allowances was compiled. Prior year allowances received under other titles were adjusted for comparability with current appropriations. Each fiscal year is presented in terms of prior year base, adjustments to base, program reductions, and program increases as shown.

NATIONAL OCEAN SURVEY  
OR&F Appropriation Allowance History by Fiscal Year  
(\$ in thousands)

	<u>1976</u>	<u>1975</u>	<u>1974</u>	<u>1973</u>	<u>1972</u>	<u>1971</u>	<u>1970</u>	<u>1969</u>	<u>1968</u>	<u>1967</u>
Prior Year Base	62,639.6	51,118.0	55,665.4	39,156.6	35,278.0	30,585.7	29,045.2	26,651.7	25,218.8	
Adjustments to Base	6,347.3	+ 2,510.6	+ 2,767.6	+ 17,094.8	+ 1,945.6	+ 2,779.3	+ 783.5	+ 1,402.5	+ 1,372.9	
Program Reductions	- 1,500.0	---	- 9,023.0	- 1,086.0	---	---	---	- 392.0	---	
Current Year Base	67,486.9	53,628.6	49,410.0	55,165.4	37,224.6	33,365.0	29,828.7	27,662.2	26,591.7	23,988.8
Program Increases	+ 983.0	+ 9,011.0	+ 1,708.0	+ 500.0	+ 1,932.0	+ 1,913.0	+ 757.0	+ 1,383.0	+ 60.0	+ 1,230.0
Total Allowance	68,469.9	62,639.6	51,118.0	55,665.4	39,156.6	35,278.0	30,585.7	29,045.2	26,651.7	25,218.0

CS3 - 8/2/76

A system change regarding leave surcharge rates was made. The NOS is now operating under separate Financial Management Center (FMC) rates, rather than under a single Major Line Component rate. As a result of this change, each FMC should prepare a Management Fund Original Cost Operating Plan to incorporate a leave account plan amount into the Cost Operating Budget Status Report. The Office of Programs and Budget is studying the feasibility of this system change.

A new commissioned officer funding arrangement was developed and will become effective July 1, 1976. Under this new funding arrangement, all pay, benefits, and allowances for commissioned officers are planned by, and charged to, the NOAA Corps Office.

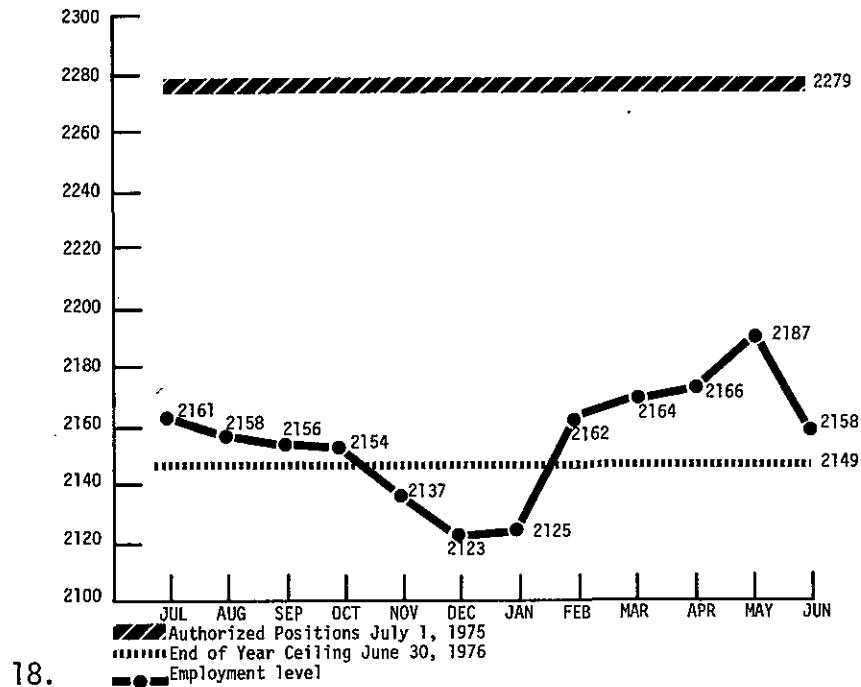
The first meeting of the reactivated Financial Management System (FIMA Council), held on April 15, was devoted to reviewing the Genasys Corporation's recommendations one by one. Those recommendations on which there was disagreement by one or more Primary Organization Elements were assigned to task groups for study, recommendation, and reporting at subsequent meetings.

As a result of the announced closing of the Lake Survey Center on June 30, 1976, a General Accounting Office audit was initiated by direction of a congressional delegation. Considerable effort was directed toward preparation of complete details of the Lake Survey Center's FY 1976 Cost Operating Plans. Every function of the Center was presented by individual position, including grade and step, as well as complete identification of other objects.

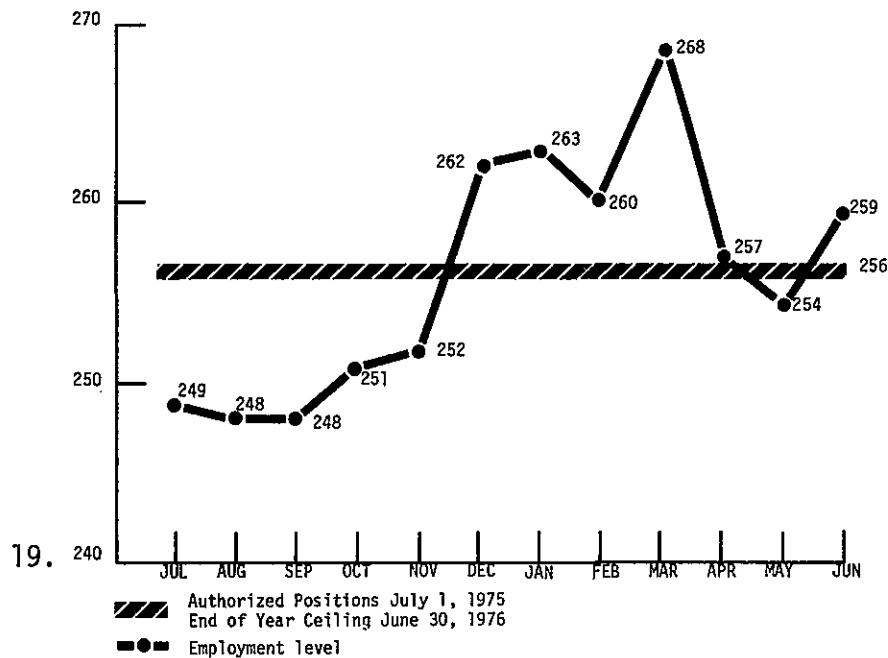
Establishment of a new NOAA organizational element, the Office of Ocean Engineering, resulted in the transfer of various program elements and resources from the National Ocean Survey. The organizational entities involved in the transfer are the NOAA Data Buoy Office and the National Oceanographic Instrumentation Center.

The full-time permanent ceiling for personnel for FY 1976 was established at 2,149 civil service positions and 256 commissioned officer positions. The graphs illustrate full-time permanent employment throughout FY 1976.

FULL-TIME PERMANENT POSITIONS  
AND EMPLOYMENT - CIVIL SERVICE  
ALL APPROPRIATIONS AND FUNDS  
FISCAL YEAR 1976



FULL-TIME PERMANENT POSITIONS  
AND EMPLOYMENT  
COMMISSIONED OFFICERS  
FISCAL YEAR 1976



## OFFICE OF MARINE TECHNOLOGY

Response to growing demands for engineering and user support products has become a priority in the Office of Marine Technology. The Engineering Development Laboratory provided engineering system design and development support and services to NOAA, and to the general marine community; a step forward was taken in deep ocean, continental shelf and drifting buoy technology with the National Data Buoy Offices' (NDBO) test and evaluation of prototype buoy systems; increasing demands for the National Oceanographic Instrumentation Center's instrument testing and calibration services continued to be met.

### Engineering Development Laboratory

Engineering system design and development was provided to support programs of the National Ocean Survey, the National Marine Fisheries Service, the Marine Ecosystem Analysis (MESA) New York Bight Project, and the Environmental Protection Agency.

#### Tests Completed:

- o Del Norte Electronic Position Subsystem, which determines subsystems time delay characteristics--phase A test and evaluation (Motorola and Raydist radio positioning subsystem test continue.)
- o Offshore Tide Telemetry System (OTTS)--to be deployed in support of the DELMARVANC Project (Delaware, Maryland, Virginia, North Carolina) phase II, field testing in New York Bight
- o Heave Error Corrector Subsystem, designed to provide corrections for pitch and roll ( $\cos\theta$ ) and heave (H) to recorded depth signals--shown in illustration 20--laboratory tests. (Field tests are currently in progress.)

#### Modifications

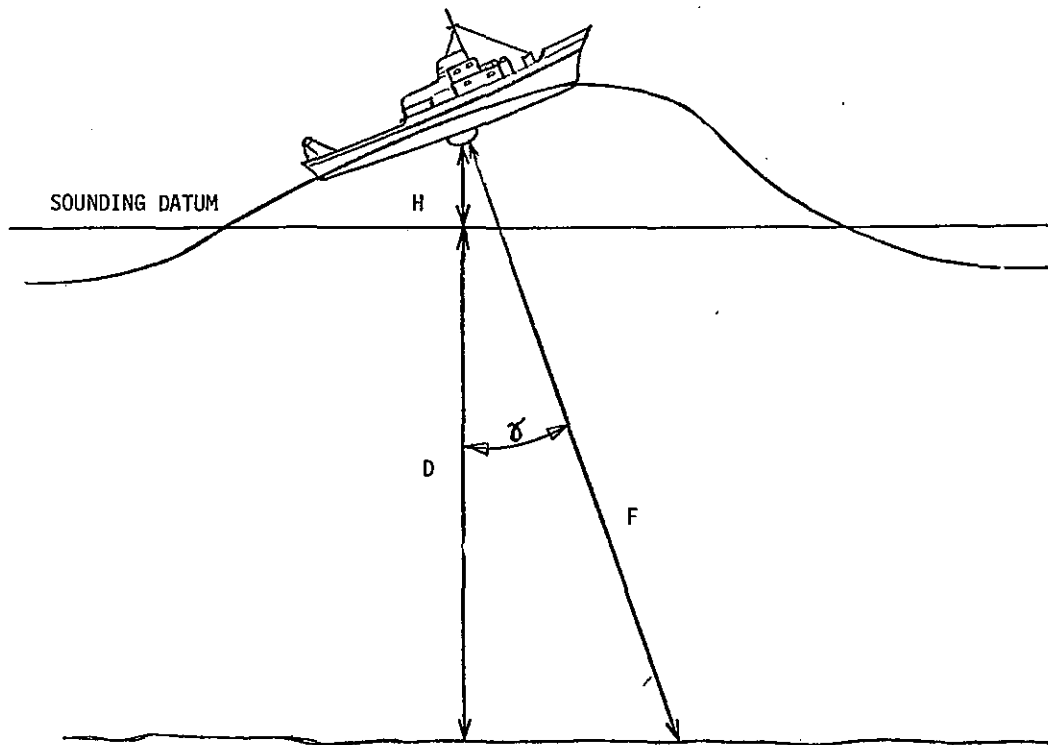
Reduction in systematic cutting errors, increasing overall reliability, was made on the Aeronautical Chart Reproduction Division's Radar Video Slide plate cutting machine. An acceptance test gage for improving the quality control of the finished slides was designed, fabricated and tested.

Through laboratory modification an increase in overall reliability was made on the Undulating Oceanographic Recorder (UOR) System, and successful field operations were carried out by the National Marine Fisheries Service.

#### Evaluation and Investigation

To improve the data quality of the Tidal Measuring System, an evaluation of ADR tide gages was made, which led to modification of ten units for a field test. Effort was directed toward increasing the level of data recovery from field records.

## HEAVE AND POINTING ERRORS



F: OBSERVED FATHOMETER DEPTH

D: TRUE DEPTH

H: HEAVE

γ: TRANSDUCER POINTING ANGLE FROM VERTICAL

$$D = F \cos \gamma - H$$

### 20. Heave Error Corrector Subsystem

#### MESA Program

Design and procurement specifications for shipboard instrumentation containers were completed for the MESA New York Bight Project.

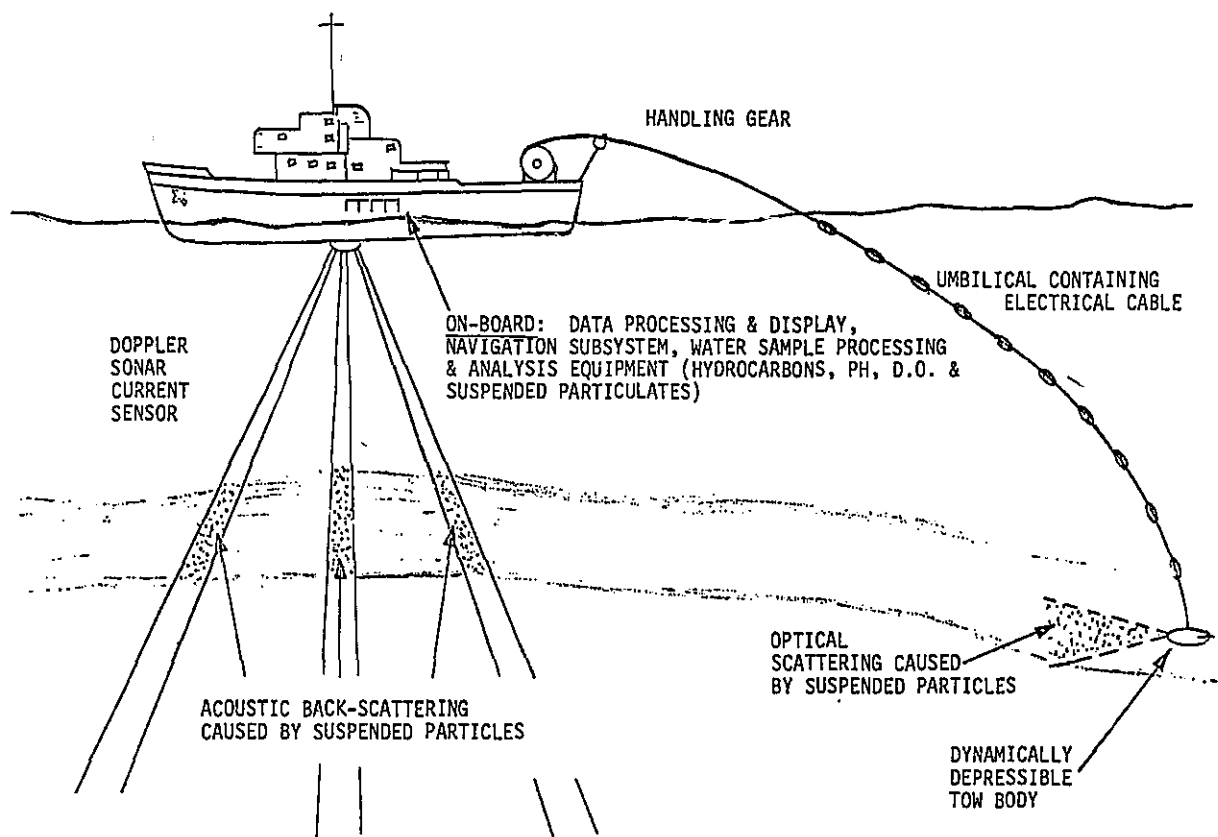
The following tasks were also accomplished in support of MESA:

- (1) design and development of data acquisition subsystem
- (2) analysis of subsystem performance to improve data quality

#### Contracts

A contract was initiated for Bathymetric Swath Sonar System with a scheduled delivery data in FY 1977. In addition, a plan was developed for testing its capabilities in improving present hydrographic survey coverage of shoals and obstructions.

Study contracts were awarded to consultants for the development of applications scenarios for the Underway Water Sampling System. This system when fully developed, will measure the impact of energy-related pollutants in the marine environments (see illustration 21).



21. Underway Water Sampling System

### Oceanographic Instrumentation

The National Oceanographic Instrumentation Center (NOIC) provided the marine community with services designed to support programs of, and jointly with, the Naval Ship Research and Development Center, Environmental Protection Agency and Atlantic Oceanographic Laboratories of the Bedford Institute of Oceanography, Canada. Negotiations were completed to further international cooperation in the seawater intercomparison program.

NOIC's regional laboratories calibrated over 3,000 ocean instruments. Careful planning assured that calibration services would be available to the oceanographic community during NOAA's reorganization of its ocean engineering programs.

The regional laboratories also participated in the Outer Continental Shelf Energy Assessment Program (OCSEAP) and continued support of the MESA program in the New York Bight area.

## Test and Evaluation

Thirteen instruments were evaluated and reported to the marine community through the Instrument Fact Sheet (IFS) program. In the future, the evaluations will be documented by limited distribution of technical reports, replacing the IFS program.

In recognition of the need to account for the effects of platform and sensor motion on measurements taken in the marine environment, particularly current sensors, a dynamic motion simulator was developed, in conjunction with the Naval Ship Research and Development Center, to simulate large-scale, wave-induced motions. Considerable progress in studying the effects of turbulence on current meter performance was achieved.

## Metrology

The development of needed water quality instruments, calibration standards and improvements in data quality for coastal environment measurements was initiated and is being monitored by NOIC's Metrology Program, in cooperation with the Environmental Protection Agency. Examples of major efforts:

- . Dissolved oxygen laboratory standard
- . Conductivity/temperature/pressure transfer standard
- . Environmental test methods for marine instruments
- . In situ chemical standards

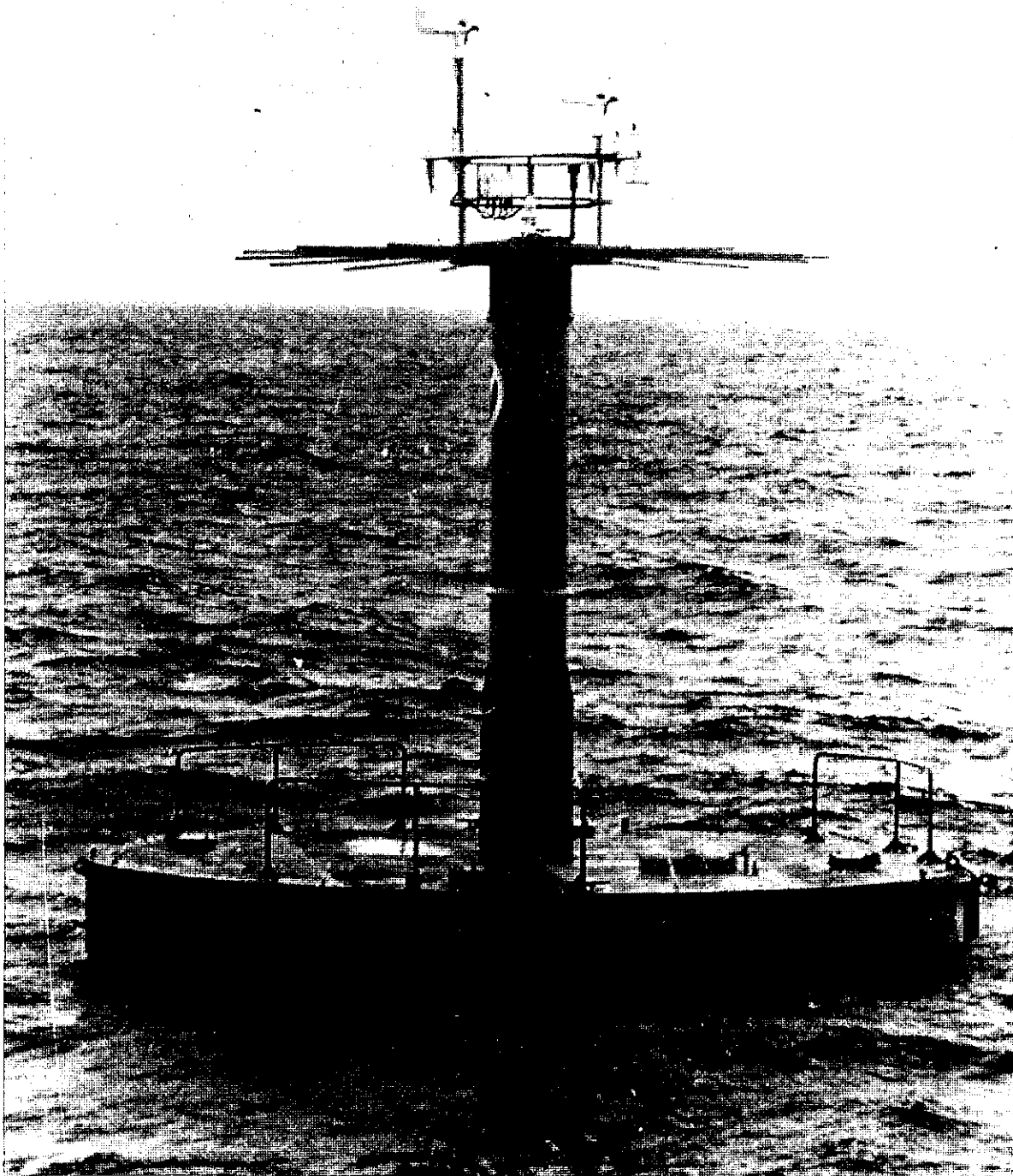
International cooperation in the seawater intercomparison program continued with the Atlantic Oceanographic Laboratories/Bedford Institute of Oceanography, Canada. France and the USSR will participate in the program next year. The U.S. seawater intercomparison program was carried out with labs located on both U.S. coasts and on the Gulf of Mexico.

## Data Buoy Program

The NOAA Data Buoy Office (NDBO) continued to advance buoy technology; to test and evaluate prototype buoy systems; and to procure, deploy and operate proven systems as specified by user organizations. Accomplishments were made in three major buoy categories: (1) deep ocean (2) continental shelf (3) drifting.

### Deep Ocean Buoy Program

During September 1975, two large experimental buoys (EB-04 and EB-10) in the Gulf of Mexico documented the passage of Hurricane Eloise as it approached the Mississippi Gulf Coast. Buoy data acquired during Eloise were unique in representing real-time acquisition during peak hurricane conditions when near-surface data were otherwise unobtainable. Environmental conditions before and after the storm were clearly documented.



22. Deep Ocean Buoy

The first Prototype Environmental Buoy (PEB) was deployed 344 nautical miles southwest of Astoria, Oregon on July 17, 1975. Five additional PEB buoys were fabricated for deployment next summer. These buoys were planned for data-sparse areas off the northwest coast of the United States and the Gulf of Alaska to serve as a prime data source for weather prediction and storm warnings in areas of storm cyclogenesis, and on the marine leg of the Trans-Alaskan Pipeline System. Two 40-foot discus buoy hulls (EB-01 and EB-15) were retrofitted with PEB payloads and deployed off the east coast of the U.S.

Six deep ocean buoys provided environmental data every three hours for national and international weather networks. These buoys are located in the Atlantic Ocean (EB-01 and EB-15), the Pacific Ocean (EB-16), the Gulf of Alaska (EB-03) and the Gulf of Mexico (EB-04 and EB-10).

Research and development objectives for deep-ocean moored buoys were directed toward providing expanded measurement capabilities, increasing the reliability of sensors and electronics, and reducing the total system cost. Development continued on a radiometer type upper-air sensor capable of measuring temperature and humidity profiles from the sea surface to an altitude of 6,000 meters. Thermistor cables were added to the PEB mooring configuration to provide subsurface temperatures to a depth of 300 meters. The Wave Measurement System was improved with the addition of a 12-channel wave spectrum analyzer system that reports one-dimensional spectral density from which wave height and period are computed. Test and evaluation of UHF buoy/satellite communication systems proved highly successful and resulted in the decision to provide only UHF communications on all future deep ocean buoy procurements.

#### Continental Shelf Buoy Program

A NOMAD hull (EB-33), deployed on the Alaskan Continental Shelf, 65 miles SSW of Yakutat, Alaska, provided data over a 10-month period that were used by the Bureau of Land Management (BLM) to assess petroleum development risks in the Gulf of Alaska. Two buoys (EB-34 and EB-41) deployed off the Atlantic east coast in October 1975 continue to furnish environmental data for the BLM and NOAA's MESA New York Bight Project. A specially designed water quality buoy (EB-52) was deployed for three months last fall near the mouth of Delaware Bay for an Environmental Protection Agency water quality monitoring effort. A meteorological and oceanographic data system, designated EB-61, was installed on a Transcon Corporation offshore platform in the Gulf of Mexico and provides data to the National Weather Service and the American Gas Association. In a cooperative effort between the U.S. Army Corps of Engineers (COE) and the NDBO, a water quality station was established in Lake Pontchartrain near New Orleans, Louisiana during June 1976. Plans were initiated with the COE to deploy a water quality system to collect data in the vicinity of the Louisiana superport.

The ocean prototype development program was initiated with the planning of a cluster experiment to be undertaken off the east coast of the United States. The general concept will be a telemetering surface meteorological

buoy with the capability of receiving underwater acoustic signals from a cluster of subsurface floats located below wave motion, supporting bottom-moored, taut-wire systems containing oceanographic sensors at discrete levels. The surface buoy will relay both surface and subsurface data. Emphasis will be on the development of reliable current measuring systems for subsurface long-term deployment. In addition, ocean prototyping included preliminary work on the development of a temperature profiling ocean sensor from the surface buoy.

Plans were developed for a Mooring Dynamics Experiment to be conducted at the Pacific Missile Test Center, Hawaii, in the fall of 1976. This joint Office of Naval Research/NDBO project is being undertaken to determine the response of surface moorings to the forces caused by wind, current, and waves.

#### Drifting Buoy Program

Development was accelerated on a variety of drifting buoy systems for meteorological and oceanographic experiments of limited duration where extended area coverage is desired and low cost is mandatory. This program involves three major areas of drifting buoy development: (1) Lagrangian (2) air/sea interaction (3) ice.

The Lagrangian buoy was developed to track water parcels for determining current flow, while simultaneously measuring a few meteorological parameters. The technique employed utilizes a "window shade" drogue that couples the surface buoy to a particular depth in the ocean's mixed layer. A complete and reliable Lagrangian buoy system was achieved through the integration of the engineering and hardware used in earlier prototype moderate and severe environment systems. Approximately 60 NDBO-designed Lagrangian buoy systems were used in more than a dozen scientific experiments. These systems were deployed in the Gulf of Mexico, the Gulf Stream off the east coast, the Aleutian Current in the Gulf of Alaska, the Bering Sea, the Pacific Equatorial Counter Current south of Hawaii, and the Antarctic Current in the South Atlantic.

A typical example of international cooperation in drifting buoy programs was the recent deployment undertaken jointly by the South African Commonwealth Scientific and Industrial Research Organization's (CSIRO) National Research Institute for Oceanology (NRIO), the South African Weather Bureau, the University of Cape Town, the NOAA Data Buoy Office, and the National Center for Atmospheric Research (NCAR). Eight buoys were deployed on the Greenwich meridian between latitudes 65°S and 35°S by a South African Antarctic supply ship.

The most recent cooperative international venture was the Joint U.S./French Drifting Buoy Experiment on April 19, 1976. Four of NDBO's severe environment buoys were deployed from the French research vessel, JEAN CHARCOT. The experiment provides the opportunity to compare Lagrangian current measurements with Eulerian current measurements, and to investigate the role of drifting buoys in mixed layer dynamics studies, particularly heat budget studies.

The air/sea interaction buoy system was a major drifter effort started in FY 1975 that was temporarily suspended with the loss of Dr. William Richardson, in the Gulf of Maine. This buoy system was expected to add a major measurement capability to that provided by deep-ocean moored buoys with emphasis on mixed layer monitoring and air/sea interaction studies. Plans to restart the program are contingent upon future requirements.

The third major area of drifting buoy development provides specialized monitoring systems for use in projects such as the Arctic Ice Dynamics Joint Experiment (AIDJEX), the Polar Experiment, baseline studies in polar regions such as the Alaskan north slope, and polar meteorological coverage such as the First GARP Global Experiment.

Development of an Arctic Environmental Buoy System (HF/NAV-SAT) was completed with the installation of eight buoys in the ice north of Alaska to support the AIDJEX Program.

The NDBO completed development of an oceanographic/meteorological ice buoy system designed to provide environmental data to support a study of near-shore sea ice dynamics as part of the NOAA/Bureau of Land Management OCSEAP operation. The 18-foot spar buoy system uses the Random Access Measurement System (RAMS) aboard the NIMBUS-6 Satellite for buoy tracking and for transmission of air temperature and pressure, buoy heading, and current speed and direction. The buoy design was based on Arctic data buoy technology developed by the NDBO over the past four years. Four of these buoys were deployed in the Arctic Ocean north of Alaska in November 1975. Two buoys are operational and continue to provide data on a regular basis. One buoy was damaged during deployment and the other was operational only two weeks. The NDBO continued the development and test of air-droppable RAMS (ADRAMS) buoys, designed to provide remote tracking of the near-shore Arctic ice pack. This requirement was established by the Bureau of Land Management in conjunction with AIDJEX. The 22-inch spherical buoy is deployed by parachute and uses the RAMS on the NIMBUS-6 Satellite for data transmission and buoy tracking.

In addition to the primary requirement of providing position information, the capability of the ADRAMS buoy is being expanded to acquire atmospheric pressure, air temperature and wind data. Design work, started in May 1975, was followed by a successful air drop of a mechanical test model in July. Initially, eight experimental buoy systems were fabricated and were successfully deployed in December 1975, on the Arctic ice pack north of Point Barrow, Alaska. Three of these buoys operated for five months; the remaining five continue to transmit data. The test program was extended to include the fabrication of eleven prototype buoys, six of which were air-dropped in March, in the same vicinity as above mentioned, and are operating normally. Another buoy was air-dropped on Ice Island T3 in May and continues to provide data. Two prototype buoys were deployed near McMurdo Sound in February 1975, to test the capability of ADRAMS to operate in the extreme cold of Antarctica. These buoys continue to furnish good data at their locations. The remaining two buoys will be deployed in FY 1977.

## OFFICE OF FLEET OPERATIONS

The Office of Fleet Operations (OFO) provides ship support for NOAA programs and manages the operation, utilization, and maintenance of 25 ships of the NOAA Fleet. Fleet operation schedules were developed to satisfy program requirements approved by the Fleet Allocation Council. Direct support of the Fleet was accomplished by the Pacific and Atlantic Marine Centers in the areas of ship logistics--including manning, maintenance/repairs, equipment and instrumentation acquisition, berthing and shore supply services.

### Operations

#### Bicentennial

The staff and Operations Division coordinated the NOAA Ship RESEARCHER's visit to the Washington Navy Yard in October, providing the NOAA Bicentennial celebration and NOAA's birthday with a focal point.

#### Membership and Clearances

The Operations Division provided membership to the Interagency Committee on Search and Rescue. To implement diplomatic clearances for NOAA ships visiting foreign waters and ports, liaison was maintained with a number of Federal and non-Federal organizations.

#### NOAA Ships

The NOAA Ships DISCOVERER, SURVEYOR, and MILLER FREEMAN continued work on the Outer Continental Shelf Environmental Assessment Program (OCSEAP). The NOAA Ships OCEANOGRAPHER and RESEARCHER supported ERL programs; ten NOAA Fleet ships supported programs of the Office of Marine Surveys and Maps; nine NOAA Fleet ships provided support to the National Marine Fisheries Service; the NOAA Ship GEORGE B. KELEZ exclusively supported MESA, New York Bight.

#### Crew Augmentation Plan

To help meet the additional requirements created by passage of the Fisheries Conservation and Management Act of 1976, a crew augmentation plan was developed for selected NOAA Fleet ships to operate for 250 days at sea.

### Marine Engineering

#### Management

The Engineering Division was active in the routine management of Fleet engineering needs. These included alterations, repair and maintenance of ships and small craft.

## Inventory

A computerized inventory system for electronics equipment was implemented. Progress was made on an extension of the inventory system, to include marine machinery.

## FAILLOG

The Electronic Failure Reporting System (FAILLOG) received widespread acceptance and use, and became more useful as a medium for analysis of equipment problems.

## Control

Documentation and control of alterations or modifications to ships and small craft were tightened.

## Replacements, New Construction and Modification

New, specially designed, superior boats (designated Type I Launches) were placed in service, replacing 10-to-15-year-old survey launches, which were phased out of service. Contracts were awarded for construction of the 12th through the 14th boats, completing the Type I building program. A headquarters engineer devoted full time as part of a concentrated effort to coordinate maintenance and modification to the new Type I Launches.

## A Major Project

An advanced design was produced for a 159-foot (49 meter) ship, visualized primarily as a fisheries research ship. Consolidated in the design are ideas from the prospective users, and advice from an experienced fishboat designer.

## Pollution Abatement

Progress was made on marine pollution abatement systems for selected NOAA ships, although funding support was not provided. The Fleet must be fitted with sewage, oil and solid waste systems to meet Federal and state requirements. Through reallocation of monies used for procurements and installations, arrangements were completed for the installation of sewage plants on the NOAA Ships PEIRCE and WHITING; oily waste plants on the NOAA Ships OCEANOGRAPHER and DISCOVERER; and surveys and recommendations on suitable sewage plants for three east coast fisheries research ships.

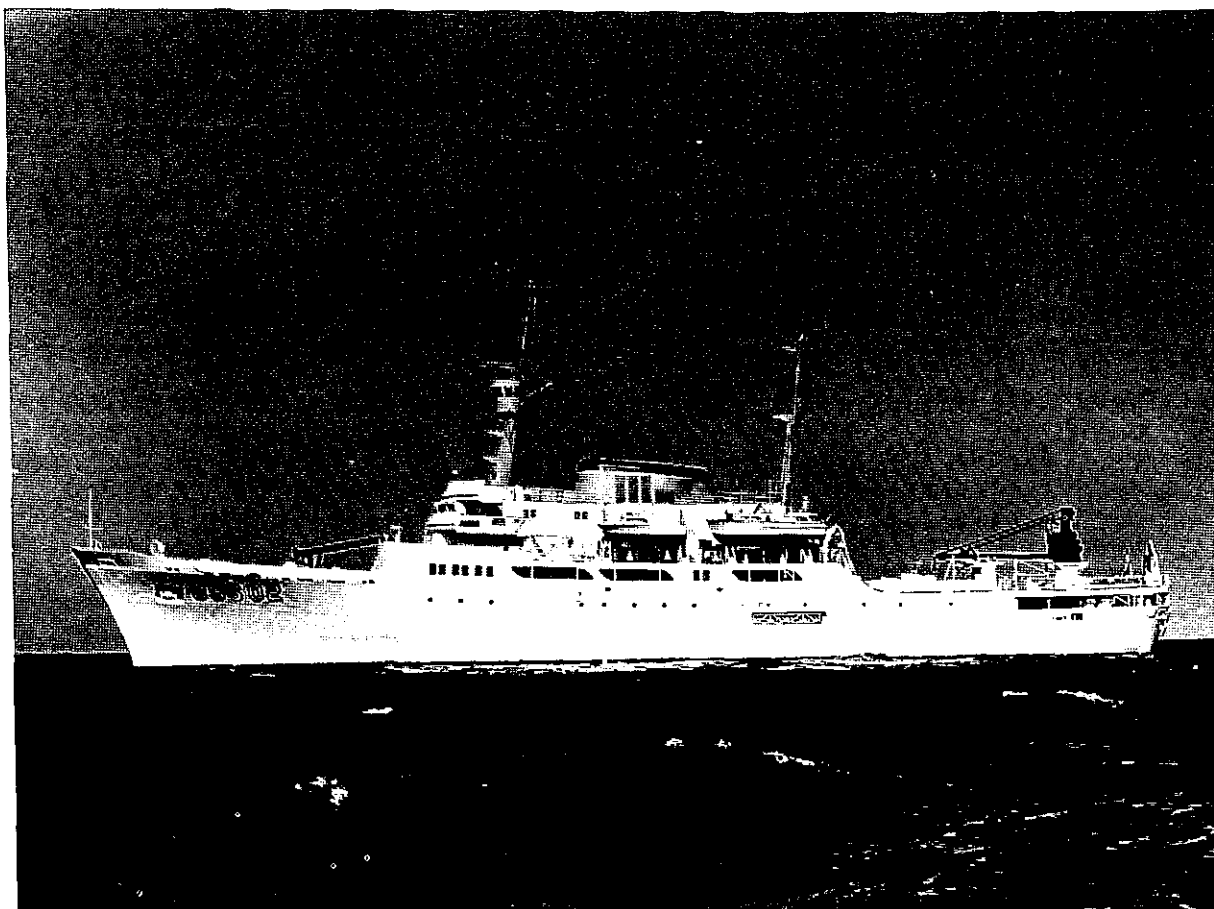
Information, advice and assistance was provided to other NOAA components not routinely supported through the Office of Fleet Operations, such as architect advisory services to the National Science Foundation and procurement and supervision of a contractor for installation of National Weather Service equipment on one of the NOAA Fleet ships.

# NOAA FLEET

CLASS	SHIP	OVERALL LENGTH	MARINE CENTER	HOME PORT	PROGRAM USE
<u>Centrally Managed NOAA Ships</u>					
I	OCEANOGRAPHER (OSS 01)	303'	PMC	Seattle	Marine Ecosystems Inv.
I	DISCOVERER (OSS 02)	303'	PMC	Seattle	Environmental Assessment
I	RESEARCHER (OSS 03)	278'	AMC	Miami	Ocean Investigations
I	SURVEYOR (OSS 32)	292'	PMC	Seattle	Environmental Assessment
II	FAIRWEATHER (MSS 20)	231'	PMC	Seattle	Hydrographic Surveys
II	RAINIER (MSS 21)	231'	PMC	Seattle	Hydrographic Surveys
II	MILLER FREEMAN (FRS 21)	214'	PMC	Seattle	Environmental Assessment
II	MT. MITCHELL (MSS 22)	231'	AMC	Norfolk	Hydrographic Surveys
III	PEIRCE (CSS 28)	163'	AMC	Norfolk	Hydrographic Surveys
III	WHITING (CSS 29)	163'	AMC	Norfolk	Hydrographic Surveys
III	McARTHUR (CSS 30)	175'	PMC	Seattle	Coastal Mapping Services
III	DAVIDSON (CSS 31)	175'	PMC	Seattle	Hydrographic Surveys
III	OREGON II (FRS 32)	170'	AMC	Pascagoula	Living Resources Survey
IV	GEORGE B. KELEZ (CRS 41)	177'	AMC	Norfolk	Marine Ecosystems Inv.
IV	ALBATROSS IV (FRS 42)	187'	AMC	Woods Hole	Living Resources Survey
IV	TOWNSEND CROMWELL (FRS 43)	163'	PMC	Honolulu	Living Resources Survey
IV	DAVID STARR JORDAN (FRS 44)	171'	PMC	San Diego	Living Resources Survey
IV	DELAWARE II (FRS 45)	155'	AMC	Sandy Hook	Living Resources Survey
IV	FERREL (ASV 92)	133'	AMC	Norfolk	Coastal Mapping Services
V	RUDE (ASV 90)	90'	AMC	Norfolk	Hydrographic Surveys
V	HECK (ASV 91)	90'	AMC	Norfolk	Hydrographic Surveys
V	OREGON (FRV 51)	100'	PMC	Kodiak	Living Resources Survey
V	JOHN N. COBB (FRV 52)	94'	PMC	Seattle	Living Resources Survey
VI	MURRE II (FRV 63)	86'	PMC	Juneau	Living Resources Survey
VI	GEORGE M. BOWERS (FRV 65)	74'	AMC	Miami	Living Resources Survey

HPT = Horsepower-tonnage=numerical sum of vessels shaft horsepower plus gross tonnage

Class I	3501 - 9000 HPT	Class IV	1001 - 2000 HPT
Class II	3501 - 5500 HPT	Class V	501 - 1000 HPT
Class III	2001 - 3500 HPT	Class VI	up to 500 HPT



23. NOAA Ship DISCOVERER (Class I - Oceanographic Surveys)

## ATLANTIC MARINE CENTER

The Atlantic Marine Center (AMC), located at Norfolk, Virginia, provides operational direction and logistic support to the NOAA vessels operating off the Atlantic and Gulf coasts. Favorable results were recorded from its participation in various activities representing NOAA/NOS, its products and services. The ability to effectively administer NOS/AMC oriented programs, services, products and activities was greatly enhanced by increased liaison and public relations throughout the theater of operations.

### Significant Events

The Public Affairs Office coordinated, and participated in:

- o the Norwegian Training Ship, CHRISTIAN RADICH's visit in conjunction with OP SAIL '76 and the 150th anniversary of Norwegian immigration to the United States (attended by approximately 15,000 visitors);
- o Change of Command ceremonies for the Directorship of AMC, April 30 (Rear Admiral Robert C. Munson succeeded Rear Admiral Alfred C. Holmes); NOAA Administrator, Dr. Robert M. White officiated; NOS Director, Rear Admiral Allen L. Powell and other VIP's were present;
- o dedication of the intercalibration Tide Gage site on Chesapeake Bay Bridge Tunnel. U.S. Representative G. William Whitehurst, 2nd Congressional District, Virginia, officiated. (Three years were required to obtain the necessary clearances for the project.)



24. Dedication of the automatic tide monitoring station, Chesapeake Bay Bridge Tunnel.

## Other Activities

The phasing out of the Lake Survey Center created an acute space shortage with the shifting of certain functions, personnel, and equipment to AMC. Processing and receipt of U.S. Army Corps of Engineers' permits totalled 20,850, an increase of 18 percent. The number of chartable items forwarded to Rockville increased 13 percent, and with the expected volume of permits from the closing of the Lake Survey Center, this office expects an additional heavy workload. Nautical and aeronautical chart sales increased 106 percent over last year, and proved a valuable tool in interfacing with, and serving, the public.

## The Southeast Marine Support Facility

Administrative, logistic, and communications support was provided to the NOAA ships; liaison was maintained with various elements in the area, particularly concerning the widening of the main channel 75 feet on the south side of Dodge Island--assistance with aids to navigation in the dredged channel was provided to the Port of Miami and U.S. Coast Guard; reconnaissance hydrographic information was provided concerning the Miami Bicentennial celebration activities July 4; activities were coordinated for the Miami Beach Boat Show February 19-26. Commander Donald J. Florwick succeeded Captain Robert W. Franklin as Officer-in-Charge July 8, 1975; and Commander Leland L. Reinke succeeded Commander Florwick March 12, 1976.

## The Northeast Marine Support Facility

Administrative, logistic and communications support was provided to NOAA ships; liaison was maintained in the Woods Hole, Massachusetts, area. Assistance and liaison was provided for the OP SAIL '76 tall ship events; liaison was maintained in the Sandy Hook, New Jersey area between the Port Captain and the National Marine Fisheries Service.

## Marine Engineering

Overall specifications were written, and personnel acted as technical representatives for ship repair contracts. Work on NOAA ships included:

- . gantry system hydraulic repairs
- . ALBATROSS IV auxiliary and main engine overhauls; drydocking, painting, valve overhaul, and transducer installation
- . GEORGE M. BOWERS annual repairs and painting
- . FERREL, GEORGE B. KELEZ, MT. MITCHELL, OREGON II, PEIRCE, WHITING, RESEARCHER repairs and modifications.

Routine maintenance of hydro launches was accomplished; Launch 1202 was automated, and Launch 1004 was delivered to AMC.

## Electronic Engineering

Support to the NOAA Fleet increased, with many of the problems being solved through close cooperation between ship and Division personnel. Shore station installations were assisted; Division personnel solved interference (electronic) and manpower problems aboard ships. Depot maintenance was enhanced by procurement of a Ross Digital Fathometer for laboratory use in repairing modules. Motorola VHF equipment was added to the depot capabilities; a depth simulator and Hazlow encoder simulator were added to the AMC Hydroplot System. Workshop/seminars for Del Norte and Raydist equipment were held during the winter inport period. Progress was made on the Rotating Electronics Technician Program, (RET's) and although it still has problems, it is functioning effectively. With clearer understanding of requirements the RET's have contributed greatly to the electronics support effort. Special efforts, procurements, and electronics installations include: a Raytheon Doppler Speed Log, installed on the ALBATROSS IV; Internav LORAN C receivers for various ships; RF 130 transmitters for the RESEARCHER; Devetron FSK units for all ships with teletype capability; new radars for Launches 1255 and 1257.

Assistance was provided in initiating a program of planned transducer replacement to aid in reducing lost ship operations time, and to improve the quality of data. A filter to prevent the RESEARCHER's cathodic protection system from interfering with seismic equipment was designed, built and installed; a prototype ADR timer was designed, built, and forwarded to ERL for evaluation.

For the first time, equipment and expertise were available within the Division to locate interference problems hampering the operations of horizontal positioning stations. One reduction of effort and personnel occurred with the transfer of tide gage maintenance to the Tides Branch.

## Operations

Coordination and support of hydrographic operations in the field were provided, while attending to pertinent administrative items. Functions were extended to include operational responsibility for areas and projects formerly conducted or coordinated by the Lake Survey Center.

## Vessel Operations

MT. MITCHELL completed a Puerto Rican project and a portion of the New York Bight hydrography, and proceeded to work on the offshore sections of the DELMARVANC project.

PEIRCE participated in the New York Bight effort; assisted in projects for the U.S. Coast Guard and NMFS facilities at Sandy Hook, New Jersey; performed chart adequacy studies in northwestern Florida; operated with the WHITING in Buzzards Bay, Massachusetts.

WHITING completed a Virgin Island project, a portion of the New York Bight hydrography, and assisted in hydrographic operations in Buzzards Bay, Massachusetts.

GEORGE B. KELEZ continued support of MESA projects and programs throughout the year.

FERREL performed current studies off North Carolina and commenced the estuarine current studies in Portsmouth, New Hampshire.

RUDE and HECK conducted wire drag operations in the Gulf of Mexico, the New York Bight area, and the Chesapeake Bay Entrance. These NOAA ships provided vital information to the U.S. Coast Guard involving wrecks and other obstructions in the New York Bight Apex.

RESEARCHER participated in a number of oceanographic projects along the east coast of the United States and the Caribbean Islands; served as host ship for a NOAA Anniversary Open House in Washington, D. C. (October); received a Unit Citation for CY 1975 accomplishments.

OREGON II, GEORGE M. BOWERS, ALBATROSS IV, and DELAWARE II supported NMFS programs on cruises involving gear testing and stock assessment operations, and continued to support NMFS projects from their respective bases.

Hydrographic Branch launches performed inshore and riverine hydrography from Baltimore Harbor to Florida.

### Coastal Mapping

Support was provided for four different programs: Airport Obstruction Surveys, Coastal Mapping, Storm Evacuation Mapping and Florida Seaward Boundary Mapping.

#### Airport Surveys

Surveys of 63 airports were conducted; 120 instrument landing systems and 13 Very High Frequency Omnidirectional Ranges (VORs) were located.

#### Photogrammetric Field Parties

Tertiary Tide gages established: 120; tidal benchmarks established: 400; horizontal control stations established in support of hydrography: 173; ADR tapes forwarded: 900; stations premarked in advance of aerial photography: 61; shoreline manuscripts field-edited: 40; Storm Evacuation Maps completed: 10.

#### Photogrammetry

Airport construction charts completed totalled 71; Shoreline Manuscripts completed totalled 48; manuscripts reviewed totalled 90.

### The Tides Branch

New stations installed: 83; serviced: 232; new tidal benchmarks established: 288; tidal benchmarks recovered: 909; miles of levels run: 200.

The Branch became more involved with the Marine Boundary Program as additional requirements were imposed and funds made available. Major efforts were made in New Jersey, South Carolina, and Florida. Eight new primary stations were established for this program and six others refurbished. The crisis of maintaining the Primary Net was alleviated by providing tide support to the charting effort independent of the Primary Net.

### Processing

Attention was devoted to automated processing and verification of hydrographic survey data and plotting wire-drag strip data for the RUDE/HECK, supporting field units with polyconic projection plots, and software refinements. The Preliminary Plan for the Modification of the Basic Hydrographic Survey Processing System was successfully implemented.

### Verification Branch

Under the Hydrographic Survey Processing System the Verification Branch achieved 33 verified automated hydrographic surveys; one processed and verified wire-drag survey; 24 verified position overlays and 21 sounding overlays; 57 hydrographic surveys were inspected prior to automation; 22 wire-drag surveys were given preliminary inspection; 12 Class I hydrographic surveys and one hydrographic field investigation were transferred to Rockville, unverified; 25 surveys were verified and forwarded. (Personnel received cross-training in the EDP Branch and the field to gain experience and to better understand the various aspects of hydrographic operations.)

### Electronic Data Branch (EDB)

The EDB wrote feasibility studies for a new digitizer system and a replacement computer/plotter system. Procurement action was initiated on both. (The computer processing system of programs is in its final stage of refinement to process survey data on a skewed projection.)

## PACIFIC MARINE CENTER

The Pacific Marine Center (PMC) is located on the eastern shore of Lake Union, at Seattle, Washington. PMC provides operational direction and logistic support to thirteen NOAA vessels, operated by the National Ocean Survey, along the U.S. West Coast, Alaska, and Hawaii.

The ship support functions of PMC continued heavy during FY 1976. Various programs including those of the NOS Office of Marine Surveys and Maps, ERL/PMEL, ERL/OCSEAP, NMFS, and NWS were prosecuted by the NOAA vessels and coordinated/supported from PMC.

### Marine Engineering

Focus continued on needed repairs and modifications for the reactivated NOAA Ships SURVEYOR, TOWNSEND CROMWELL, and the MILLER FREEMAN. A number of series propulsion problems developed, and were dealt with during the period.

#### Significant Modifications

##### OCEANOGRAPHER

- . Jumboizing of stern A frame
- . Installation of oil water separator
- . New cathodic protection system

##### DISCOVERER

- . Installation of oil water separator

##### SURVEYOR

- . Rehabilitation of mess area

##### MILLER FREEMAN

- . Initiation of bow thruster installation

##### RAINIER

- . Davit modification

##### DAVIDSON

- . Davit modification

##### McARTHUR

- . Engineer room soundproof booth

Drydockings were conducted for the NOAA Ships OCEANOGRAPHER, DAVIDSON, McARTHUR, DAVID STARR JORDAN, OREGON, JOHN N. COBB, and MURRE II.

## Launches

A new hydrographic launch was provided for the NOAA Ship RAINIER and two were provided for the NOAA Ship DAVIDSON. Plans were made to make four additional launches available during FY 1977; one to be provided to AMC, and the remaining three to be supplied to PMC hydrographic vessels. These launches provide a significant upgrading in hydrographic data acquisition.

Launch contractor defaults continued with Martinolich defaulting on four launches. As in the past, Boat Yard, Inc. completed these launches and was awarded a contract for four additional launches.

## Electronic Engineering

Progress was made in consolidation of the Division. The gradual filling of ET positions generated the ability for base repair (depot maintenance) and for intensive winter work in refurbishing HYDROPLOT and other equipment.

Progress was made to near-completion of the electronics inventory, the conception of Maintenance Plans and Equipment Record Folders, and new emphasis in the area of oceanographic instrumentation and data quality. Assistance was provided in the establishment of the Oceanographic Programs Group at PMC. Increasing responsibility was assumed for OCSEAP instrument support.

## Operations

With the full time dedication of three vessels to the support of the Outer Continental Shelf Environmental Assessment Program (OCSEAP), greater demands were placed on the Operations Division in FY 1976.

The addition of three persons permitted a degree of specialization and, accordingly, closer support of OCSEAP was possible. The responsibility for oceanographic data quality was accepted by PMC. An Oceanographic Programs Group was established to facilitate cooperation and understanding between the scientific programs and the vessels. This group prepared a PMC Oceanographic Procedures Manual and conducted training classes on field procedures to assure consistency of operations and data quality control. Standard output formats for the PODAS systems aboard DISCOVERER and OCEANOGRAPHER were established. A short description of the system capability was disseminated to the scientific community.

## The PMC Photogrammetric Party.

Winter training classes continued in field horizontal control, photogrammetric, and field edit procedure. Field deployment for the party included photogrammetric projects at Kaneohe Bay, Oahu, and Hilo Bay, Hawaii, in October; photogrammetric paneling and tide control data for Santa Barbara and Morro Bay, California; and shoreline photogrammetry in the spring. In May, similar paneling and tide data operations were conducted for shoreline

photography for portions of Shelikof Straits, Cook Inlet, and Kachemak Bay, Alaska. On July 28, the party boarded the Coast Guard Ice Breaker BURTON ISLAND to provide survey support for Coast Guard Aids to Navigation along the Arctic Coast from Icy Cape to Prudhoe Bay.

### The Pacific Tide Party

Installation, inspection, and data monitoring continued of the Pacific Tide Gages for NOS, and inspection continued of the NWS Tsunami Warning System Gages. Gages at St. Paul Island, Nome, and two at Prudhoe Bay were installed for OCSEAP. The first gages for the California Tidal Boundary Project were implemented. Extensive procurement was related to this program.

With the increased number of ships and related communication requirements during the fall of CY 1975, it was determined the PMC Radio Station (KVJ) needed improvement for effectiveness. Meetings with the Coast Guard Communicator resulted, to improve the flow of radio communications with the ships and to furnish the ships with a PMC Communications Manual which included the Coast Guard's "Non-Coast Guard Users Guide." Radio Station KVJ's teletype capability was increased; a Coast Guard teletype line was installed; and the conversion to SSB duplex was accomplished.

### Processing

Extensive changes in the processing of hydrographic surveys were made. The policy that all hydrographic surveys would be processed within one year of field work completion was initiated. Accordingly, the hydrographic vessels were directed to finish, within six weeks of field work completion, their processing and report-writing and to transmit the survey data to the Processing Division. This procedure will result in a more even processing load at the base. This year Headquarters, Rockville, review of verified surveys was delegated to the Marine Centers.

A Hydrographic Survey Inspection Team was formed consisting of the Chief of the Processing Division, Assistant Chief of the Operations Division, Chief of Electronic Data Processing, and the leader of the processing team which was not involved in verification of the survey under inspection. Upon the Team's recommendation, the Director, Pacific Marine Center, is now authorized to approve the survey.

A Rotating Cartographic Technician program aboard hydrographic vessels was instigated. This program was designed to provide a vital link, and to improve information and data flow from field acquisition through the office processing stages. As a survey technician position became vacant on DAVIDSON and RAINIER, the position was converted to a GS Rotating Cartographic Technician Team position.

The data received from the field--now quite free of errors, due in large measure to the smooth computer boatsheet--are further refined before entering the processing routine and graphic displays. Various options and

the increased flexibility available to production processing on the Harris System resulted in quality refinement previously unobtainable. The Iron Ensign and the 1620 IBM systems were surplused.

### Vessel Operations

DISCOVERER devoted full time to prosecution of the Outer Continental Shelf Environmental Assessment Program (OCSEAP) in the Gulf of Alaska and the Bering Sea; received a Unit Citation for CY 1975 accomplishments.

SURVEYOR devoted full time to OCSEAP work, and to intensive surveys of the intertidal areas bordering the Bering Sea and the Gulf of Alaska (the NOAA helicopter was aboard, substantially augmenting the SURVEYOR's capability).

MILLER FREEMAN devoted full time to OCSEAP investigation support as a fisheries vessel in the Bering Sea; received a Unit Citation for CY 1975 accomplishments

OCEANOGRAPHER devoted primary time to the completion of a segment of the Ocean Atmosphere Response Studies (OARS) Program, and to support the Deep Mining Environmental Studies (DOMES) in Hawaiian waters. (DOMES is designed to provide independent assessment of the probable impact on the marine ecosystem from planned deep ocean mining of manganese nodules and other minerals.)

FAIRWEATHER continued hydrographic survey operations in Shelikof Strait, Alaska; resumed hydrographic surveys centered in Santa Monica Bay off the southern California coast after a brief inport, and until the winter inport period; completed hydrographic surveys along the southern California coast between the Los Angeles area and Point Dume; conducted hydrographic surveys in the vicinity of Kalgin Island, Cook Inlet, Alaska.

RAINIER conducted hydrographic surveys in Trading Bay, Upper Cook Inlet, Alaska; hosted a luncheon for Secretary of Commerce Rogers C. B. Morton, members of his staff and local DOC representatives; completed hydrographic surveys for San Clemente and Santa Catalina Islands, California; completed hydrographic surveys in Kaneohe Bay, Oahu Island in Hilo Harbor, Hawaii; completed a survey south of Lanai Island, Hawaii (for the Defense Mapping Agency).

DAVIDSON conducted hydrographic surveys in the vicinity of Kalgin Island, Upper Cook Inlet, Alaska; conducted a special chart adequacy survey in the entrance to Kachemak Bay, Alaska; conducted several special investigations off Montague Island, Prince William Sound, Alaska; conducted a chart adequacy survey in San Francisco Bay, California; conducted special hydrographic investigations in Sergius Narrows in Peril Strait, including the channel and West Frances Rock; commenced navigable area surveys in a corridor between Henchinbrook Entrance and Middleton Island in Prince William Sound.

McARTHUR conducted tide and current surveys in Upper Cook Inlet, Alaska (a four-year-project completed in three years); conducted tide and current surveys in the Strait of Juan de Fuca and the Puget Sound area; conducted a deep water, high current station test in Haro Strait; conducted a successful search for the Coast Guard VTS Buoy "SA"; conducted tide and current surveys in Price William Sound, Alaska.

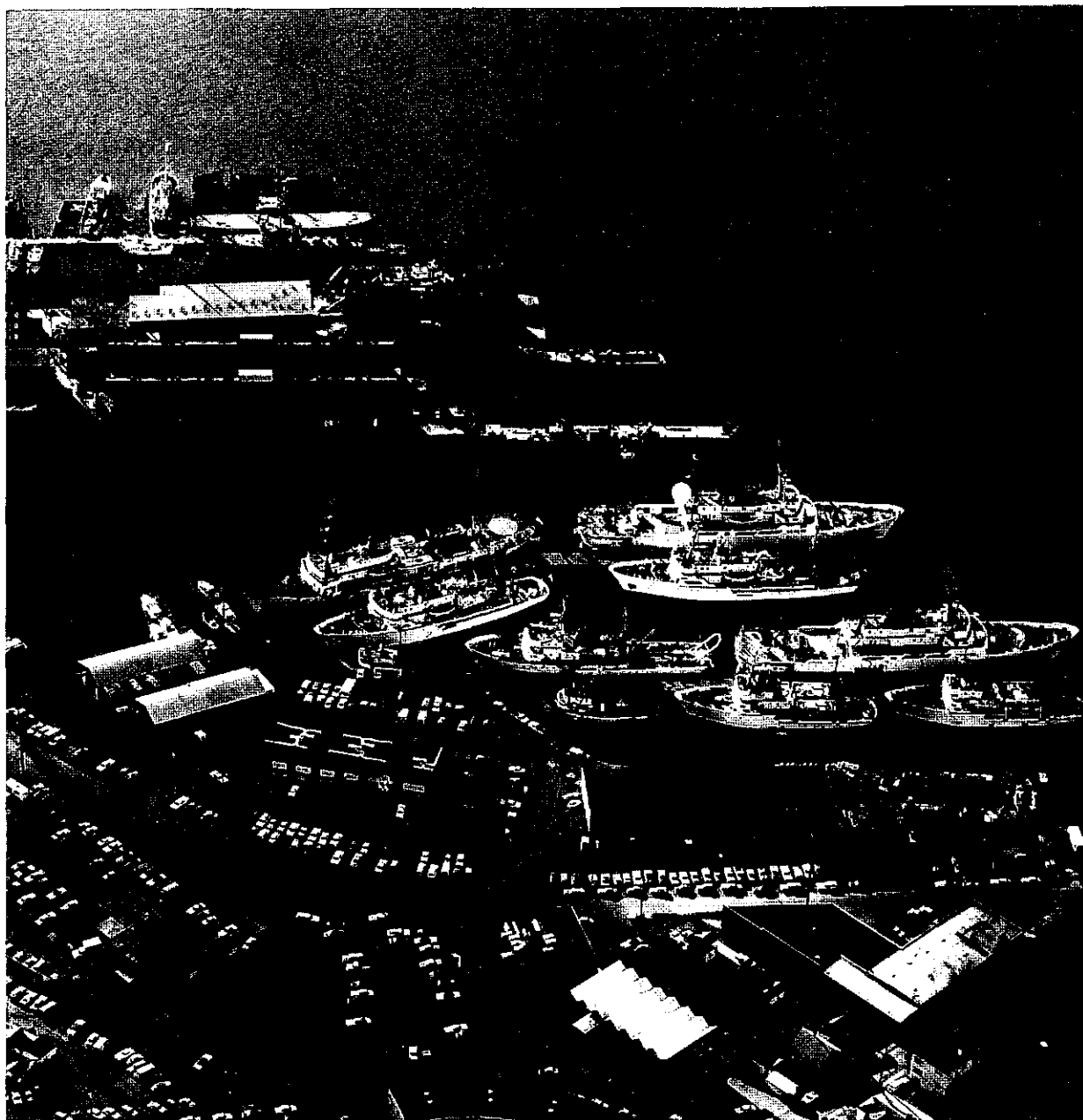
DAVID STARR JORDAN conducted operations in the coastal waters off southern California on the California Cooperative Fisheries Investigation (CalCOFI); made a larval fish study off southern California; participated in the Eastern Tropical Pacific Porpoise Distribution Survey; made a hydro acoustic study; engaged in albacore resource assessment off the California coast; rendezvoused with the NOAA Ship TOWNSEND CROMWELL at the Galapagos Islands (January); made a port call at Puntarenas, Costa Rica.

TOWNSEND CROMWELL completed albacore/oceanographic investigations; was recommissioned with suitable ceremony at the Kewalo Boat Basin, Hawaii; began a project on skipjack tuna scouting and shrimp trawling on French Frigate Shoal; completed a resource assessment in the Hawaiian Islands; conducted a fish and shellfish assessment of the northeastern Hawaiian Islands; participated in the Eastern Tropical Pacific Porpoise Distribution Survey; conducted a microstratification survey in southern California waters; completed a resource assessment and skipjack tuna tracking project in the northeastern Hawaiian Islands; began operations on the Western Pacific PTFD Purse Seine Expedition in Guam; rendezvoused with the NOAA Ship DAVID STARR JORDAN in the Galapagos Islands (January); made port calls in Cocos Island and Costa Rica.

JOHN N. COBB conducted a groundfish survey in the Gulf of Alaska; conducted a hake survey along the coastal waters from central Vancouver Island to central California; conducted a herring survey and groundfish survey in southeast Alaska; participated for the third consecutive year in the Salty Sea Days celebration at Everett, Washington.

OREGON conducted work on the Bering Sea survey; conducted and completed a shrimp survey in the vicinity of the Shumagin Islands and a shrimp resource assessment in the Gulf of Alaska; began operations on a project in the Bering Sea; received a Unit Citation for CY 1975 accomplishments.

MURRE II conducted various environmental and marine mammal cruises, fisheries operations and freight hauls in support of the National Marine Fisheries Service field stations throughout southeast Alaska; conducted a herring survey in Alaska; conducted two logging effects studies and herring surveys; conducted a salmon tagging cruise; made various freight hauls.



25. Aerial view of the Pacific Marine Center, Seattle, Washington.

## LAKE SURVEY CENTER

The Lake Survey Center conducted comprehensive charting and water level surveys of the Great Lakes and their outflow rivers--i. e., Lake Champlain, portions of the Hudson River and New York State Barge Canal, Lake of the Woods, Rainy Lake, and the Minnesota-Ontario Border Lakes. Engineering support was provided to various state, regional, Federal and international organizations; administrative, technical and scientific service operations (required to support Lake Survey Center (LSC) work, and that of NOS).

### Engineering

Support services were provided to maintain and repair the vessels, instruments, electronic and automotive equipment used by NOAA and NOS in carrying out its various missions.

### Charts and Publications

Data for new chart editions and additional prints of Great Lakes charts were gathered, compiled and sent to NOS for printing and distribution. Data for the Monthly Bulletin of Lake Levels were prepared each month until that function was transferred to the U.S. Army Corps of Engineers, Detroit District. Material for the chart catalog was sent to NOS for publication.

### Hydrography

Revisory surveys were made in harbors on Lakes Huron, Superior and Erie; Rainy Lake, Lake of the Woods, and along the St. Mary's and Niagara Rivers. Hydrographic and horizontal control surveys were conducted along the south central shore of Lake Erie.

Assignments were completed in the continuing joint NOS-CHS (Canadian Hydrographic Services) Technical Exchange Program. During the course of their activities, the survey parties performed field inspections and serviced the network of NOS water level gages in the areas of operations.

### Coastal Zone Mapping and Services - Estuarine and Lake Investigation

A total of 55 permanent and approximately 40 temporary and seasonal water level gages were operated and maintained. These gages, located on the shores of the Great Lakes and along the connecting channels, monitor water level fluctuations. Two graphic, year-round, non-recording telemetering gages were maintained on Lake Erie and the lower Detroit River; and eight year-round, recording telemetering gages were maintained on Lakes Ontario, Erie, Huron, St. Clair and Superior. Six of these telemetering units were installed at the request of the U.S. Army Corps of Engineers to aid in carrying out its responsibilities on Lake Superior and the St. Lawrence River International Boards for coordinating outflow requirements from Lakes Superior and Ontario. Four digital water level gages were installed to provide data for a special study being undertaken by the U.S. Army Corps of Engineers' Coastal Engineering Research Center. A network of 18 water tem-

perature recorders was operated and maintained for the Great Lakes Environmental Research Laboratory.

A total of 157 miles of precise leveling was completed on Lakes Michigan and Huron as part of the long-range program of updating the International Great Lakes Datum (1955).

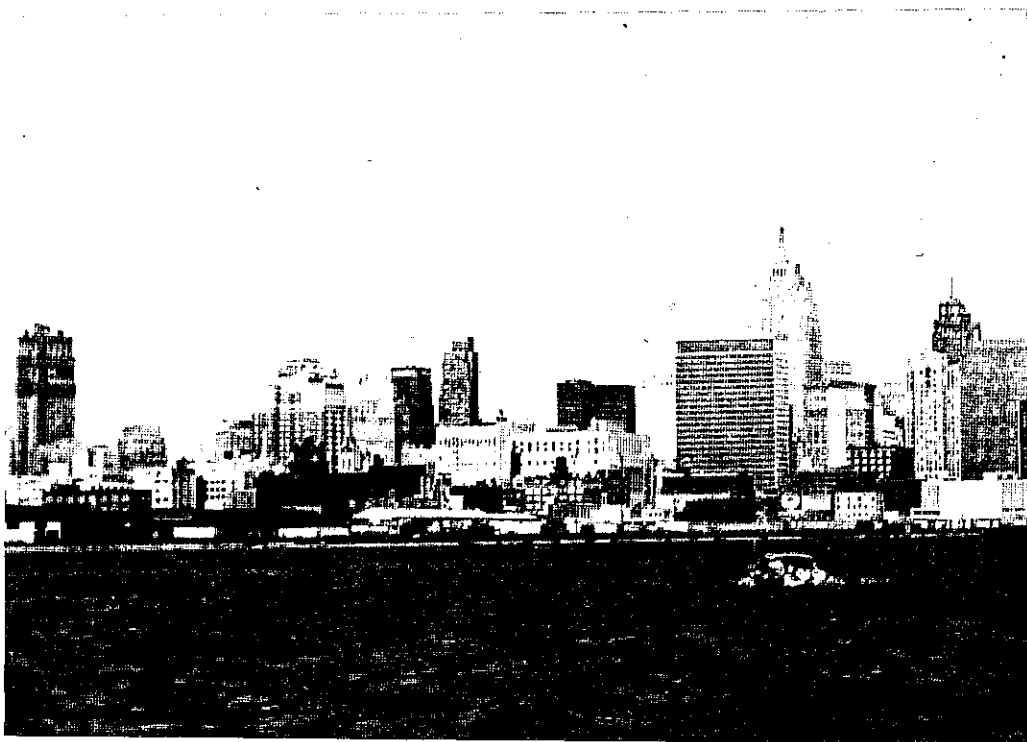
#### Photogrammetry

Preliminary stereocompilations of Erie Harbor, Ashtabula Harbor, and the St. Clair River Flats area were completed. The Detroit River was compiled for a total of six stereo models. Aerotriangulation work was completed on Point Au Gres prior to stereocompilation.

Photogrammetry support was given to all three field units in the form of aerial photography; office support was provided for targeting horizontal control stations prior to aerial photography operations.

#### Transfer of LSC Functions

The Detroit-based Lake Survey Center was disbanded effective at the close of FY 1976. Its functions were transferred to the National Ocean Survey, Rockville, Maryland, and to NOS' Atlantic Marine Center, Norfolk, Virginia.



26. Detroit River Waterfront; LSC Center Building

APPENDIX

PUBLICATIONS ISSUED

Annual

Coast Pilot 1, Atlantic Coast, Eastport to Cape Cod; 1975 Edition

Coast Pilot 2, Atlantic Coast, Cape Cod to Sandy Hook; 1976 Edition

Coast Pilot 3, Atlantic Coast, Sandy Hook to Cape Henry; 1976 Edition

Coast Pilot 5, Atlantic Coast, Gulf of Mexico, Puerto Rico and Virgin Island; 1976 Edition

Coast Pilot 7, Pacific Coast, California, Oregon, Washington and Hawaii; 1976 Edition

Coast Pilot 8, Alaska, Dixon Entrance to Cape Spencer; 1969 Edition

Seventh Supplement to Coast Pilot 8, Alaska, Dixon Entrance to Cape Spencer; 1969 Edition

Eleventh Supplement to Coast Pilot 9, Pacific and Arctic Coasts, Cape Spencer to Beaufort Sea; 1964 Edition

Great Lakes Pilot, 1976

Tide Tables. East Coast of North and South America, 1977

Tide Tables. West Coast of North and South America, 1977

Tide Tables. Europe and West Coast of Africa, 1977

Tide Tables. Central and West Pacific Ocean and Indian Ocean, 1977

Current Tables. Atlantic Coast of North America, 1977

Current Tables. Pacific Coast of North America and Asia, 1976

Miscellaneous

NOAA Technical Report NOS 65 NGS-1, The Statistics of Residuals and the Detection of Outliers

NOAA Technical Memorandum NOS NGS-1, Use of Climatological and Meteorological Data in the Planning and Execution of National Geodetic Survey Field Operations

NOAA Technical Memorandum NOS NGS-2, Final Report on Responses to Geodetic Data Questionnaire

NOAA Technical Memorandum NOS NGS-3, Adjustment of Geodetic Field Data Using a Sequential Method

NOAA Technical Memorandum NOS NGS-4, Reducing the Profile of Sparse Symmetric Matrices

NOAA Technical Memorandum NOS NGS-5, National Geodetic Survey Data: Availability, Explanation, and Application

Supplemental Tidal Predictions, Anchorage, Alaska, 1976

Summary of National Ocean Survey Technical Publications and Charts

PAPERS CLEARED THROUGH NOS FOR PRESENTATION

AIAA-AAS-Astroynamics Conference, Nassau (July 1975)

Goad, Clyde - A study of Orbit Determination Accuracies for  
Future Observatory Missions

16th General Assembly of the International Association of Geodesy of the  
International Union of Geodesy and Geophysics, Grenoble, France (August 1975)

Bossler, John D. - Status of the New Adjustment of the North American  
Horizontal Datum II

Carroll, Dennis G. - Model II Analysis of Variance of Astronomic  
Latitude and Longitude

Schwarz, Charles R. - The Geodetic Data Base at the National Geodetic  
Survey

Gergen, John G. - National Geodetic Survey Computer Programs for  
the Adjustment of Horizontal Networks

Dracup, Joseph F. - Use of Doppler Positions to Control Classical  
Geodetic Networks

Holdahl, Sandford R. - Strategies and Models for Computing Vertical  
Crustal Movements in the United States

Carroll, D. G. - A 1975 Astrogeodetic Geoid for the United States

Strange, William E. - The Satellite Doppler Station Network in the  
United States

Strange, William E. - Reobservations Over the United States Gravity  
Base Network

Strange, William E. - Monitoring of Secular Changes of Gravity in  
the United States

Hothem, L. D. - Evaluation of Precision and Error Sources Associated  
with Satellite Doppler Positioning

Strange, William E. - Earth Model Parameters and Coordinate Systems

Meade, B. K. - Terrestrial Control Surveys

Douglas, Bruce C. - Methods for Analysis of Long Periodic Orbit  
Variations

Pope, Allen J. - The Statistics of Residuals and the Detection of Outliers

Henriksen, Soren W. - Relation Between Fundamental Astronomical Constants and the Major Geodetic Constants

Lucas, James. R. - Results of Aerotriangulation with Apollo Lunar Photography

MTS/IEEE Conference, San Diego, California (September 1975)

Nicholson, W. M. - Ocean Instrumentation: Problems and Promise

The Connecticut Society of Civil Engineers, Inc., North Haven, Connecticut (October 1975)

Cook, James L. - The History of the National Geodetic Surveying and Geodetic Control Surveys in Connecticut

Flight Mechanics/Estimation Theory Symposium, Goddard Space Flight Center, Greenbelt, Maryland (October 1975)

Goad, Clyde E. - The Determination of Mean Orbital Elements Using Filtering Techniques

Florida Society of Professional Land Surveyors, St. Petersburg Beach, Florida (October 1975)

Dracup, Joseph F. - A Potpourri of Geodetic and Other Surveying Items

ASP-ACSM Fall Convention, Phoenix, Arizona (October 1975)

Keller, Morton - Analytic Aerotriangulation Utilizing SKYLAB Earth Terrain Camera (S-190B) Photography

Fall Meeting of the American Geophysical Union, San Francisco, California (December 1975)

Morrison, Foster - Data Dependent Least Square Collocation for Estimating the Very Short Wavelength Components of a Surface Density Layer Model of the Geopotential

Goad, C. C. & Douglas, B. C. - Computation of Mean Elements by Numerical Filtering

Whiting, Marvin - Adjustment of Geodetic Field Data Using a Sequential Method

First Venezuelan Congress of Geodesy, Maracaibo, Venezuela (December 1975)

Pfeifer, Ludvik - Use of Ferrero's Formula to Estimate a Priori Variance of Horizontal Directions

ACSM Colorado Section and ASP Rocky Mountain Region, Denver, Colorado (January 1976)

Holdahl, Jeannie H. - National Geodetic Survey Information Center and the User

ASP-ACSM Convention, Washington, D.C. (February 1976)

Schemery, L. W. - Copperplate Engraving (Nautical Charts)

Berry, Ralph Moore - History of Geodetic Leveling in the United States

Safford, Robert - New Trends at the National Geodetic Survey

Stem, James E. - The National Geodetic Survey Data Base as a Central Depository of Geodetic Control Data

Carrol, Dennis G. - Accuracy of Astronomic Azimuths

Dracup, Joseph F. - The United States Horizontal Control Network 1816-1976

Collins, J. - Modern Technology Meets Romantic Disorder: Mapping Worcester, Massachusetts

Munson, Robert C. - Status of U.S. Federal Mapping, Charting, Geodesy, and Surveying 1976 within NOAA/NOS

Meade, Buford K. - The Mason-Dixon Mile

Snay, Richard A. - Optimizing Computer Storage of Normal Equations

First United National Regional Cartographic Conference, Panama City, Panama (March 1976)

Randall, James P. - A Modern WAC Concept VFR Radio Navigation Chart

Randall, James P. - Report of Cartographic Activities of the Americas

American Geophysical Union Spring Meeting, Washington, D.C. (April 1976)

Balazs, E. I. - Crustal Uplift in the Anchorage, Alaska, Region as Indicated by Repeated Leveling and Gravity Observations

Morrison, Foster - Data-Compression Techniques for Reducing Altimetry and Other Geodetic Data

Pope Allen - The Creusen Sequential Adjustment Techniques Using Modified Arithmetic, Some Algebraic Background - M. Whiting

Goad, Clyde - Storage and Retrieval of Satellite Altimeter Data - F. Morrison & B. Douglas

Meade, B. K. - Review of Geodetic Measurements Along the San Andreas Fault

Strange, William E. - Repeat Gravity Measurements Prior to the San Fernando Earthquake

Snay, Richard A. - Reducing the Profile of Sparse Symmetric Matrices

California Land Surveyors Association Annual Convention, N. Hollywood, California (April 1976)

Gregen, John G. - The New Adjustment of Horizontal Networks in the United States

U.S. Naval Observatory, Washington, D.C. (April 1976)

Strange, William E. - National Geodetic Survey Potential Uses of Radio Interferometry Information

15th Annual Canadian Hydrographic Conference, Ottawa, Ontario, Canada (April 1976)

Thomas, Ernest E. - After the Next Decade of NOS Nautical Charting

National Aerospace Symposium of the Institute of Navigation, Warminster, Pennsylvania (April 1976)

Cangelosi, Joseph - Aircraft Position Charts

Institute of Environmental Sciences, Philadelphia, Pennsylvania (April 1976)

Russin, Eugene M. - Marine Instrument Testing - A National Program

Geology Society of America and National Association of Geology Teachers, Santa Maria, California (May 1976)

Chovitz, Bernard - Geodetic Positioning for LAGEOS

West Virginia Association of Land Surveyors Convention, Charleston, West Virginia (May 1976)

Dracup, J. F. - Geodetic Surveys in West Virginia: Past, Present and Future

Fourth National Congress on Photogrammetry, Mexico City, Mexico (May 1976)

Whalen, Charles T. - First-Order, Class III Leveling Preliminary Test Results

Regional Mapping & Land Records Conference-Delaware Valley, King of Prussia, Pennsylvania (June 1976)

Dracup, Joseph F. - Why Control Surveys - and Cooperation with the National Program

Mapping, Charting and Aerial Photography (MCAP) Committee, St. Louis, Missouri (June 1976)

Keller, Morton - NOS Study of Applied Photobathymetry

Scientific Applications of Lunar Laser Ranging, University of Texas, Austin, Texas (June 1976)

Henriksen, Soren W. - The Relationship Between Geodetic Data from Lure and Other Sources

COSPAR XIX, Philadelphia, Pennsylvania (June 1976)

Morrison, Forster - Azimuth-Dependent Statistics for Interpolating Satellite Altimetry Data

Chovitz, Bernard - Improvement of the Global Gravity Field from Satellite Altimetry

Topical Conference on Geodetic Measurements in the Ocean, University of Illinois at Urbana, Champaign, Illinois (June 1976)

Lill, Gordon G. - Surveying and Mapping the Continental Shelf's Bottom Topography

Henriksen, Soren - Bootstrapping: A method for Finding the Geoid

Strange, William E. - The Use of Doppler Satellite Methods of Offshore Positioning

PAPERS CLEARED THROUGH NOS FOR PUBLICATION

Berstis, K. and Stawnycky M. - Stable Ship-Deployable Transducer Fixture, for "Exposure" Newsletter, Oregon State University, June 1976

Henriksen, Soren W. - Role of Extremely Accurate Surveying Techniques in Existing Geodetic Networks, for Proceedings of the Scientific Applications of Lunar Laser Ranging (SALUR) Conference, sponsored by COSPAR, June 1976

Hicks, Steacy D. - Tides and Tidal Currents, for Chapter XXXI of "American Practical Navigator," August 1975

Keller, Morton - Analytic Aerotriangulation Utilizing SKYLAB Earth Terrain Camera (S-190B), for Photogrammetric Engineering & Remote Sensing, Everybody's Press, Hanover, Pennsylvania, May 1976

Meade, B. K. - Terrestrial Control Surveys, for U.S. National Report to the XVI General Assembly of IUGG; August 1975

Morrison, Foster - Algorithms for Computing the Geopotential Using a Simple Density Layer, for Journal of Geophysical Research, March 1976

Nicholson, W. M. - Ocean Instrumentation: Problems and Promise, for MTS Journal, September 1975

Snay, Richard A. - Reducing the Profile of Sparse Symmetric Matrices, for Bulletin Geodesique, March 1976

Woodward, William E. - Aanderaa Compass Calibrations, for "Exposure" Newsletter, Oregon State University, May 1976

IN RECOGNITION . . .  
NOS AWARDS AND CITATIONS

Silver Medal

Captain John O. Boyer, Office of Marine Surveys and Maps, for major contributions toward the advancement of international cooperation in nautical charting; for outstanding leadership in citizen-government interrelations for safety at sea.

NOS Outstanding Employee of the Year

Hannah G. Kelly, Office of the Director, Pacific Marine Center.

Bronze Medals

George F. Berner, Office of Aeronautical Charting and Cartography, in recognition of innovative management ability and expertise in formulating distribution systems.

Louis Brisky, Office of Aeronautical Charting and Cartography, for achievements in map and chart programs.

Carmine M. Cogliano, Office of Aeronautical Charting and Cartography, for dedicated service and superior technical support in the reproduction of navigational charts.

Lewis V. Evans, III, Office of Marine Surveys and Maps, for exceptionally competent leadership and technical excellence in the development of concepts and policy for nautical charting in the United States.

George L. Fernandes, Pacific Marine Center, for outstanding contributions to international scientific cooperation and exceptional performance in logistics planning for NOAA's survey and research vessels.

Alec Slepitz, Office of Aeronautical Charting and Cartography, for major contributions in the preparation and maintenance of accurate aeronautical charts.

John H. Sykes, Jr., Atlantic Marine Center, in recognition of numerous, notable contributions to the National Ocean Survey.

Unit Citations

Aeronautical Chart Automation Project, Office of the Director.

Nautical Engraving Section, Negative Engraving Branch, Reproduction Division, Office of Aeronautical Charting and Cartography.

Unit Citations (continued)

Physical Science Services Branch, Scientific Services Division,  
Office of Program Development and Management.

NOAA Ship DAVID STARR JORDAN, Pacific Marine Center.

NOAA Ship MILLER FREEMAN, Pacific Marine Center.

NOAA Ship OREGON, Pacific Marine Center.

NOAA Ship RESEARCHER, Atlantic Marine Center.

Special Achievements Awards

James H. Taylor, Coastal Mapping Section, Photogrammetric Branch,  
Coastal Mapping Division, Office of Marine Surveys and Maps.

William J. Golder and Leslie H. Perry, Photogrammetric Research Branch,  
Coastal Mapping Division, Office of Marine Surveys and Maps.

Society of American Military Engineers Karo Award

NOAA Ship GEORGE B. KELEZ, Atlantic Marine Center.

Society of American Military Engineers Colbert Medal Award

Lt. Cdr. Ludvik Pfeifer, Office of the Director, Office of National  
Geodetic Survey.

## INTERNATIONAL COOPERATION

### Through VISITORS TO NOS

#### Portugal

1975

Lt. Cdr. Carlos Souto, of the Hydrographic Institute, toured NOS facilities and was briefed on activities of Marine Surveys and Maps.

July 24

#### Thailand

Lt. Gen. Kulkasem Chumphon, Director, Royal Thai Survey Department, and his aide, Col. Subong Kot Thanom, Royal Thai Armed Forces were briefed on NOS programs and activities.

August 5

#### East Africa, India, South America, Indonesia

A group of 15 graduate and undergraduate students of marine biology and fisheries research attended an NOS-activities orientation. The students represented 5 different countries --Kenya, Mombasa and Tanzania (East Africa); Nepal, India; Brazil, South America; and the capital city of Jakarta, Indonesia.

August 21

#### New Zealand

Mr. Ian F. Stirling, Surveyor General of New Zealand, toured the Marine Data Systems Project, was briefed on the activities of the National Geodetic Survey, and on the activities of the Offices of Marine Surveys and Maps, Aeronautical Charting and Cartography.

September 23

#### Thailand

Professor Somvhang Tandalak, Head, Department of Survey and Engineering, Chulalongkorn University, Bangkok, participated in a training program concerned with geodetic and aeronautical charting activities.

December 3-5

#### Egypt

1976

Mr. Farid Dishnaw, Director, Aviation Information Services, Civil Aviation Organization, Cairo, toured the Aeronautical Chart Division, Office of Aeronautical Charting and Cartography.

January 22

Republic of China

Lt. Tsu-Yueh Suen and Lt. Chen-Kuo Shen, Republic of China Navy began a 13-week training course in the Oceanographic Division, Office of Marine Surveys and Maps.

January 27

West Germany

Scientists from the Institute for Photogrammetry and Engineering Surveying, Technical University, Hannover, toured the Coastal Mapping Division, Office of Marine Surveys and Maps.

February 17

France

Mr. Rene Mayer, Director, Institut Geographique National, toured the NOS Display Center, the National Geodetic Survey, and Chart Automation Computer Facilities.

March 25

Brazil

Officials were briefed on NOS operations and toured the Aeronautical Chart Division, Office of Aeronautical Charting and Cartography.

April 26-27

Canada

Dr. Gerard Lachapelle, Geodetic Survey of Canada, toured the National Geodetic Survey.

April 26-30

Canal Zone

Major James L. Holmes, Jr., Chief, Flight Information Office, Defense Mapping Agency's Inter-American Geodetic Survey, toured the Office of Aeronautical Charting and Cartography.

May 6

Thailand

Lt. Cdr. Thanom Charoenlaph, Royal Thai Navy, toured the Oceanographic Division, Office of Marine Surveys and Maps.

May 10

Japan

Mr. Tadahiko Katsura, Survey Division, Hydrographic Department, Maritime Safety Agency, Tokyo, began a one-year assignment as a guest scientist.

May 21